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THE FOUDROYANT AND THE SANTA FE—A COMPARISON OF THEN AND NOW.

IT was a happy thought of Messrs. Yarrow & Company, of Poplar, London, to whom we are indebted for the accompanying illustration, when they decided to photograph their newly constructed craft in close proximity to the old Foudroyant, whose keel was laid more than one hundred years ago. The contrast is an instructive one, and exemplifies the advance which has taken place, not merely in warship building, but in the whole art of mechanical construction. It would be difficult to find a more impressive evidence of the radical changes wrought by the dawn of the age of steel, and the vastly enlarged powers with which it has endowed mankind. The old two-decker was of 3,500 tons displacement, her speed was from twelve to fourteen knots in favorable weather, and her guns had all they could do to penetrate the wooden sides of the enemy. The torpedo boat destroyer is of but 250 tons displacement, or one-fourteenth the size of the Foudroyant, yet she can steam at double the speed, and were mounted fourteen 12 pounders. Upon a lofty poop were mounted six 18 pounder carronades.

Her principal dimensions were as follows:

	Ft.	In.
Length of gun deck	183	8½
" keel	151	5⅝
" over all	219	0
" on water line	193	6
Breadth extreme	50	7¾
Depth	22	6
Draught forward	23	4
" aft	25	7
Tonnage, old measurement	2,062 tons	
Displacement probably about	3,500 tons	
Number of crew	713	

Although she is over a century old, her oak timbers are as sound as when she was launched.

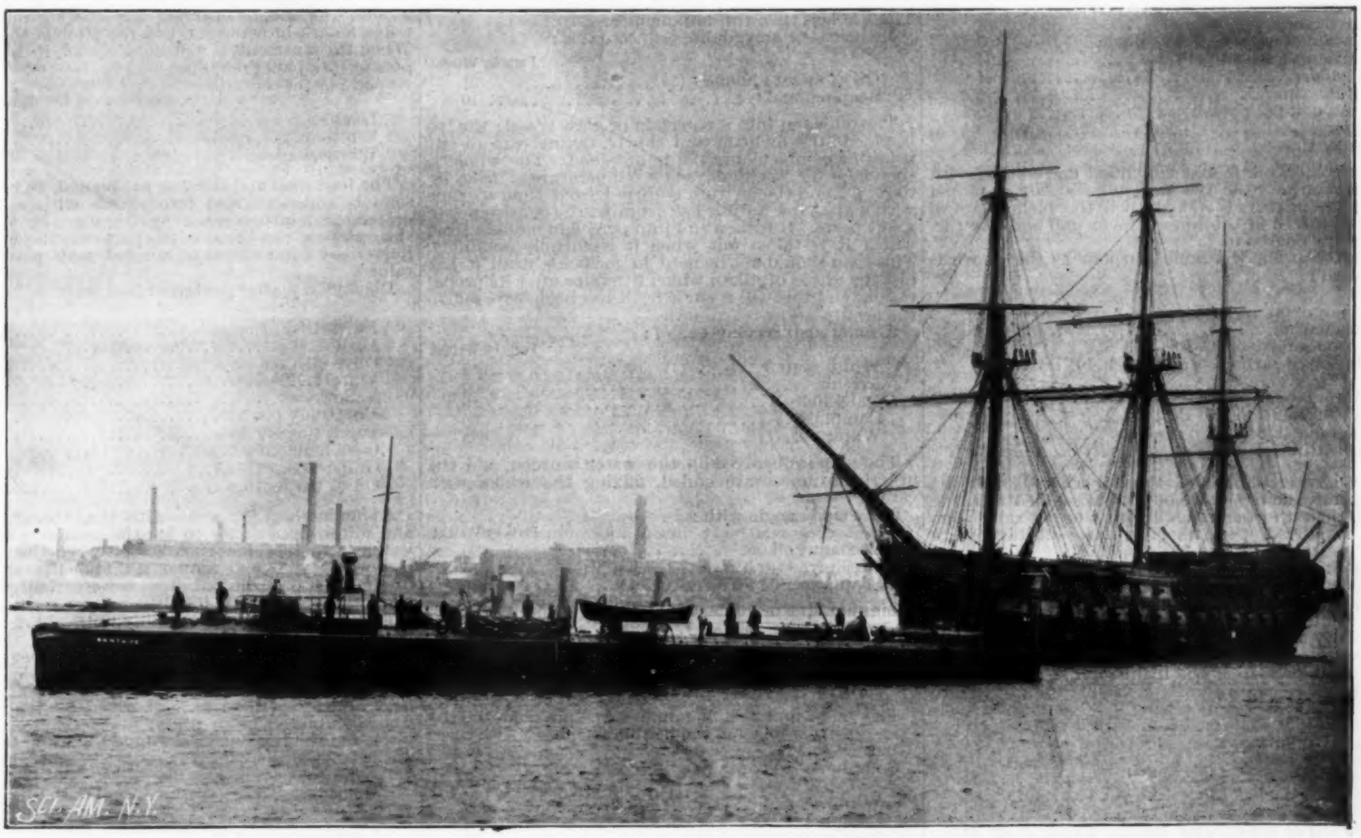
Our illustration shows the Foudroyant as she now appears after a complete refit, which was undertaken with a view to placing her on exhibition as a perfect example of a fighting ship of the last century. The refitting of the hands of the Admiralty, she had been sold to a foreigner, and was on her way to a German port to close her career in exile and ignominy, forgotten by the countrymen of Nelson.

"Happily, before her doom was sealed, the facts relating to her were made public, and it was seen that at all hazards so ignominious a fate must be averted.

"The Lord Mayor of London expressed his willingness to open a Mansion House fund for the purpose of buying her, but time did not admit of this, and when the German owner telegraphed that the demolition had been commenced and would be proceeded with unless the price he asked were at once forthcoming, the amount was privately paid and the ship was forthwith towed back to the Thames."

Regarding the Santa Fe, Messrs. Yarrow & Company write us as follows:

"There is nothing very special about this vessel excepting that it is partially armored abreast of the machinery and boiler spaces down to well below the water line, as is also the deck, the object being to give some protection to the machinery and to the men in



NELSON'S FLAGSHIP FOUDROYANT AND THE DESTROYER SANTA FE—A COMPARISON OF THEN AND NOW.

carries in her torpedo room weapons that could sink half a dozen Foudroyants in as many minutes.

The Foudroyant is one of the most interesting relics of the English navy of the days of Admiral Nelson. She was modeled on the lines of a French frigate of the same name, which was captured in 1758. The French warships of the eighteenth century were famous for their speed: they could show a clean pair of heels to anything afloat, and it is evident that the French navy included a Burgess or a Herreshoff among its designers, whose ships were more than a match for those turned out of British yards. From the day of her launch the Foudroyant was a success. Under favorable conditions she was capable of sailing (so history says) fourteen knots an hour, which was many knots faster than the speed of the average fighting ship of those days. In type she came somewhere between the 98 gun three-decker and the 74 gun two-decker, and combined the fighting power of the battleship with the speed and handiness of the cruiser. She was always a special favorite with the great English admiral. He chose her as his flagship, and as such she was fully the equal of the old Victory which carried Nelson to victory and to death at Trafalgar.

The Foudroyant carried her guns mainly on two decks: a lower deck, running the full length of the ship, mounting thirty 32 pounder smooth bores and a main deck mounting thirty-two 24 pounders. She had a forecastle carrying four 12 pounders and two carronades, intended for sweeping the enemy's decks, an open waist and a long quarter deck, upon which was undertaken by private parties, who rescued the Foudroyant from a German contractor, who had purchased the hulk for the purpose of breaking it up. The story of the rescue of this famous relic is thus told by the present owners:

"On August 11, 1892, there was quietly towed away from Plymouth Harbor what was, with a single exception, the most famous ship of the British navy that has survived to the present day. A voyager down Channel, meeting the stately old line-of-battle ship in tow of a tug, traveling eastward in the glow of a summer evening, would have been reminded of Turner's 'Fighting Téméraire,' and have guessed that this, too, was the last voyage of a blind and helpless warrior. How vastly would the interest and pathos of the sight have been increased had he known that the ship before him had been launched in the same year as the Téméraire, that she had carried the flag of Nelson as commander-in-chief in the Mediterranean, that she had been the home of a king and queen, the latter the sister of Marie Antoinette, that to her had struck the only two line-of-battle ships that had escaped the clutch of Nelson at the Nile, and that on board her had expired a hero of the sister service, who died like Nelson in the arms of victory, the good and gallant Sir Ralph Abercromby.

"Even this, however, was not all. It would still have remained to be told that the ancient craft, freighted with so many memories, was not, like the Téméraire, passing to an honored end on the shores she had so well defended; but that, after passing out closed within these spaces, which form the vital part of the vessel.

"We built some eight years ago the Kotaka for the Japanese government, which was armored also, and was a vessel somewhat similar to the present destroyers. The Kotaka turned out a great success during the recent war, and the protection that was obtained was very valuable, which was clearly indicated by the comparative immunity from damage through shot as compared with other torpedo boats which were built with the usual thin plating.

"On the 18th inst. we had a preliminary trial with the Entre-Rios, which is a similar vessel to the Santa Fe, and we obtained a speed of 27¼ knots, carrying a load of 50 tons.

"We think there can be no question that the partial armoring of the vitals of a vessel of this kind deserves the very serious consideration of naval authorities. Although it might involve the loss of a knot in speed, it is quite possible that what is obtained in exchange leaves an ultimate gain. Certainly men who are at work inside the vessel would have far more energy and presence of mind if they felt they were partly protected."

DR. EDWARD S. HOLDEN, director of the Lick Observatory, has received the decoration of knight of the Royal Order of the Dannebrog of Denmark. The order was founded in 1219. Though formerly a military order, it is now conferred for distinguished services to science.

INDUSTRIAL AND MEDICINAL SOAPS.

INDUSTRY uses an enormous quantity of diverse sorts of soaps in the fulling of woolens, in the dyeing and printing of textiles, the scouring of fleeces, etc. Some of these have a soda base, others one of potash; the latter is to be preferred, as it gives the goods a silky feel, whereas soda, on the other hand, makes them somewhat harsh to handle. These soaps are sometimes made with oleic acid, sometimes with olive oil; the former are often the most alkaline, but this is because all necessary precautions in their manufacture have not been taken. Still, all soaps intended to be used industrially should be absolutely pure and neutral, as an excess of potash or of soda is harmful to the majority of textiles. As for foreign matters, they are equally hurtful, even resin and silicate of soda, which can be employed so usefully for household soaps. The former of these articles gives to woolens, silk or cotton stuffs a shiny and greasy look that is unfavorable to the mordanting, dyeing and finishing of the goods. Silicate cuts the superficial fibers and robs the tissue of strength.

For these reasons, manufacturers who use soap in their business have it analyzed frequently, and keep themselves informed concerning the composition of the particular sorts they purchase, so that they generally get them pure. Herewith we give the composition, according to Moride, of the principal soaps used in the industries:

Menotti's hydrofuge soap is used to waterproof tissues. It is got by decomposing a rather alkaline ordinary soap with a solution of sulphate of alumina of 15° Be.

Wax soap, employed under the name of "furniture polish" for cleaning furniture and parquet flooring, is prepared in the following manner:

Pure carbonate of potash, 125 gm., is dissolved in 4 kilos of water, and heated, then 1¼ kilos of yellow wax and 165 gm. of transparent soft soap are added. The whole is boiled for a quarter of an hour, with constant stirring. A more or less fluid matter is obtained, according to the rapidity of the evaporation.

Soap for spots and stains is made with:

	Parts by Weight.
Cocoanut oil	25
Caustic soda lye, 36° Be	13
Solution of carbonate of potash, 10° Be	3
Solution of sea salt, 13° Be	4
Ox galls	4
Ultramarine	0·2
Bichromate of potash	0·2
Water	0·4
Turpentine	0·5

The cocoanut oil is first saponified and colored with the ultramarine; the lye and the sea salt are then added; the mixture is stirred, then the bichromate of potash dissolved in the water, the ox gall and the turpentine are poured in.

Ox gall soap for the same purpose as the above is made with:

	Parts by Weight.
Cocoanut oil	50
Ultramarine	0·1
Caustic soda lye, 40° Be	20
Solution of carbonate of potash, 10° Be	4
Ox gall	3
Bichromate of potash	0·05
Sea salt solution, 15° Be	2·5
Ammonia liquid	2·5
Turpentine	2·5

After having saponified the oil colored with the ultramarine, the carbonate of potash is added with the ox gall, then the bichromate with the sea salt. The whole is stirred, then the two last substances are added.

Copper and iron soaps, used to give plaster articles the appearance of antique green bronze or Florentine bronze, are made by decomposing an alkaline soap with a solution of sulphate of copper or of sulphate of iron. They are soluble in fatty oils, and especially so in turpentine.

Pumice stone soap is got by dissolving cocoanut oil soap in a small quantity of water and running it into moulds. Half its weight of powdered pumice stone is added, and the whole is stirred until it sets.

Sand soap contains:

	Parts by Weight.
Cocoanut oil	50
Caustic soda lye, 38° Be	30
Soda crystals	10
Solution of sea salt, 20° Be	10
Water	30
Glycerin	10
Fine sand	150

After saponification the sea salt is added, together with the water, glycerin and soda crystals. The sand is incorporated in the moulds.

Soap to preserve skins is made with:

	Parts by Weight.
Pulverized arsenious acid	32
Dried carbonate of potash	12
Distilled water	32
Marseilles mottled soap	32
Powdered quicklime	40
Refined camphor	10

The arsenious acid and the carbonate are dissolved in the distilled water, and the mixture is brought to the boil; the soap is added cut into as fine shreds as possible, and the mass is taken off the fire. After complete solution the quicklime and the camphor are added, the latter being pulverized with the aid of alcohol. Finally the mixture is ground up thoroughly.

MEDICINAL SOAPS.

In medicine and pharmacy soaps are used for various purposes with a base of alkali or alkaline earths—the first are soluble, the others insoluble. Among the soluble soaps—that is to say, those with a base of potash, soda, or ammonia—there are three descriptions: first, those which contain substances capable of giving them new properties without taking away those which are proper to them; secondly, medicaments made by adding extracts to soap powder; and, thirdly, alcoholic preparations containing enough soap to make a sort of jelly. The insoluble soaps have generally oxide of lead as a base, and are known as plasters, salves, or ointments. They are prepared with or without water, and in certain cases at a temperature far beyond the boiling point. They then take a brown color by reason of the alteration of a part of the fatty body.

Grease soap is made with:

	Parts by Weight.
Veal suet	50
Soapmakers' lye	25
Distilled water	100
Sea salt	10

The suet and the water are heated together in a porcelain capsule. After fusion, the lye is added little by little, stirring constantly. The heat and the stirring are maintained until complete saponification. The sea salt is then added, the solution being assisted by a very slight agitation. The soap which forms on the surface is taken off and drained. It is then melted at a gentle heat and run into moulds, where it solidifies on cooling.

The soapmakers' lye in this and succeeding recipes is composed of:

	Parts by Weight.
Dry carbonate of soda	5
Quicklime	4
Distilled water	60

Filter the solution through cloth. Wash the residue and evaporate quickly in a silver vessel until the boiling liquid shows a strength of 36° Be.

Transparent phenic acid soap contains:

	Parts by Weight.
Cocoanut oil	400
Suet	300
Castor oil	300
Soapmakers' lye	550
Alcohol	300
Glycerin	200
Sugar sirup	400
Crystallized phenic acid	80
Palm oil	5

The cocoanut oil and the suet are melted, and the castor oil is added, followed by the lye mixed with the alcohol. To the paste thus made, the phenic acid, liquefied beforehand, is added, and finally the palm oil. The whole is then run into moulds.

Medicinal or amygdalin soap contains:

	Parts by Weight.
Oil of sweet almonds	21
Soapmakers' lye	10

The oil is put into a porcelain or glass vessel; the lye is added little by little and slowly, taking care to stir it until a complete mixture is obtained. The whole is then kept for several days at a temperature of from 18° to 20° C., and the mixture is stirred from time to time with a glass rod until it has acquired the consistency of a soft paste. It is then run into porcelain moulds, from which it is taken out when it is entirely solidified. This soap should not be used in medicine until it has lost the excess of alkali which it retains after its preparation, and this will occur after it has been exposed to the air for one or two months.

Arsenic soap is composed of:

	Parts by Weight.
White soap	625
Arsenic	500
Quicklime	10
Camphor	60
Water	625

The soap is dissolved in the water warmed, and the other substances are added, mixing the whole with care.

Tar soap is made with:

	Parts by Weight.
Cocoanut oil	100
Beech tree tar	15
Soapmakers' lye	60

Lignum vitæ or guaiacum soap is made of:

	Parts by Weight.
Amygdalin soap	20
Lignum vitæ resin	10
Alcohol	1

The jalap and scammonium soaps are made in the same way by replacing the lignum vitæ resin with these drugs.

Camphor soap contains:

	Parts by Weight.
White soap	500
Camphor	8
Blanched bitter almonds	60
Tincture of benzoin	40

The almonds are reduced to a paste, the camphor is added, then the mixture of benzoin and the soap; and the mixture is moulded in the water bath.

Naples soap is composed of the following mixture, which is perfumed with a little essence of thyme, sassafras, neroli, or gillyflower:

	Parts by Weight.
Amygdalin soap	15
Grease soap	15
Nutmeg butter	8
Cacao butter	8
Laurel water	15

Ammoniacal soap contains:

	Parts by Weight.
Oil of sweet almonds	8
Ammonia	1

Another formula gives:

	Parts by Weight.
Grease soap	30
Alcohol	250
Ammonia	8

The soap scraped into shreds is dissolved in the alcohol, and the ammonia is added.

Turpentine soap is prepared by pulverizing and sieving carbonate of potash, adding essence of turpentine, and then turpentine, and triturating the mixture until it has taken the consistency of honey. The proportions are:

	Parts by Weight.
Refined carbonate of potash	1
Essence of turpentine	1
Turpentine	1

Vaselin soap is made by melting slowly:

	Parts by Weight.
Cocoanut oil	10
Vaselin	2

and adding 50 grammes of soapmakers' lye. When the mass is quite clear, it is run into moulds and perfumed.

Lead soap or simple plaster is made of:

	Parts by Weight.
Pulverized litharge	1
Axunge (pig's lard)	1
Olive oil	1
Water	2

The lard, oil and water are put into a copper vessel, of which the capacity is three times greater than the volume of the materials. The mixture is melted over a gentle fire; the litharge is added through the sieve, and stirred up with a wooden rod. The boiling is kept up by adding warm water from time to time as evaporation proceeds. The materials are stirred up constantly with the wooden rod until the oxide of lead has altogether disappeared, and until the mass has taken a uniform white color and a consistence of plaster, which is gaged by throwing a small quantity of the contents of a pan into cold water and rubbing it between the fingers. The mass is then removed from the fire, and, while still warm and soft, is kneaded to eliminate the water.

Brown soap plaster, or Mère Thécle's ointment, is prepared with:

	Parts by Weight.
Olive oil	10
Lard	5
Butter	5
Yellow wax	5
Litharge	5
Mutton suet	5
Purified pitch	1

The fatty materials are put into a big copper kettle and warmed until they give off vapors indicating the alteration of the fatty bodies. The litharge is then added by passing it through a sieve, the whole being constantly stirred with a wooden rod. The mixture is left on the fire, continuing the stirring until it has taken a dark brown color, and the pitch is then added. When the ointment is sufficiently cool, it is run into pots or into paper moulds.

Soap plaster contains:

	Parts by Weight.
Lead soap	2000
White wax	100
White soap	125

The lead soap and the wax are melted, and the white soap is added, divided into shreds with a knife, or grated, and incorporated by stirring. By adding to this plaster one-hundredth part of its weight of pulverized camphor, camphorated soap plaster is obtained.

Diachylon plaster contains:

	Parts by Weight.
Pulverized litharge	62
Lard	62
Olive oil	62
Water	125
Yellow wax	12
Burgundy pitch	12
Larch turpentine	12
Gum ammoniac	10
Galbanum	10
Oil of turpentine	6

A simple plaster is made with the litharge, lard, oil, and water, taking care to let the greater part of the water evaporate in order to preserve the glycerin. Separately the gum ammoniac and the galbanum, broken in pieces, are put into a water bath with the oil of turpentine with four times its weight of water. The mixture is stirred constantly until the gum resins become an emulsion, and is then passed through a cloth. The emulsion is then evaporated over the open fire until it has the consistency of thick honey. Next it is mixed with the simple plaster melted at a gentle heat, and after these have been melted together and passed through a cloth the yellow wax, the Burgundy pitch and the turpentine are added, stirring constantly until the mass is sufficiently cool to handle. It is then divided into convenient sized pieces.

Mercurial soap plaster is prepared with:

	Parts by Weight.
Lead soap	200
Yellow wax	10
Colophane	10
Bdellium	3
Gum ammoniac	3
Olibanum	3
Myrrh	3
Saffron	2
Mercury	60
Styrax	30
Larch turpentine	10
Volatile oil of lavender	1

The bdellium, olibanum, myrrh and saffron are reduced to powder; then the styrax, turpentine and oil of lavender are triturated in a slightly warmed iron mortar, adding, little by little, the mercury until the metallic globules have completely disappeared. In the meantime the lead soap is melted with the wax, colophane and gum ammoniac, and the substances already pulverized are incorporated in this mixture. When the ointment has cooled to the consistency of a soft pomade, the mercurial mixture is added and incorporated by stirring until the mass is homogeneous. It is then allowed to cool and divided into convenient sized pieces.

Sulphate of zinc plaster is made with:

	Parts by Weight.
Lead soap	800
White wax	50
Pure sulphate of zinc	25

The sulphate is dissolved in a little water, and this solution is added to the soap and the wax melted together. The mixture is warmed, gently stirring constantly until the water is evaporated.

Camphorated minium or Nuremberg ointment is composed of:

	Parts by Weight.
Lead soap	600
Yellow wax	300
Olive oil	100
Minium	150
Pulverized camphor	12

The lead soap and the wax are melted together and the ground minium is added with the olive oil. When the mass is nearly cold, the camphor is put in.—J. Lefevre, in Oil, Paint and Drug Reporter.

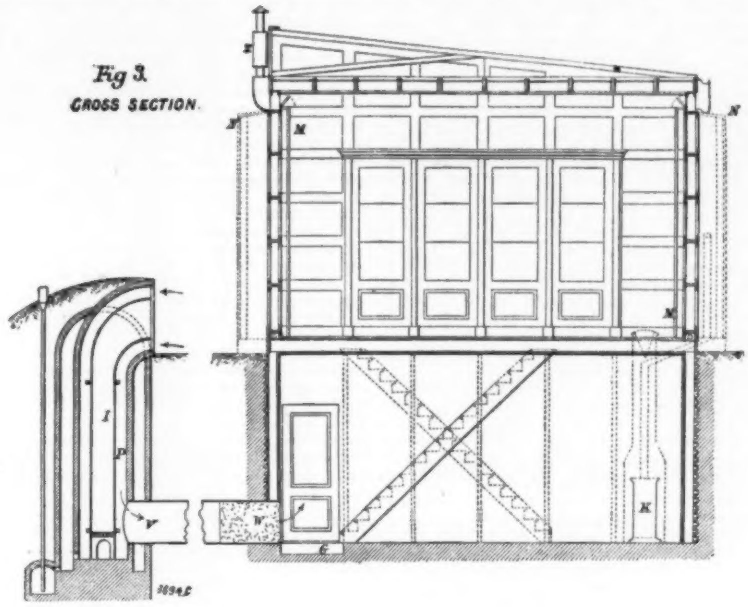
A REMARKABLE HOUSE.

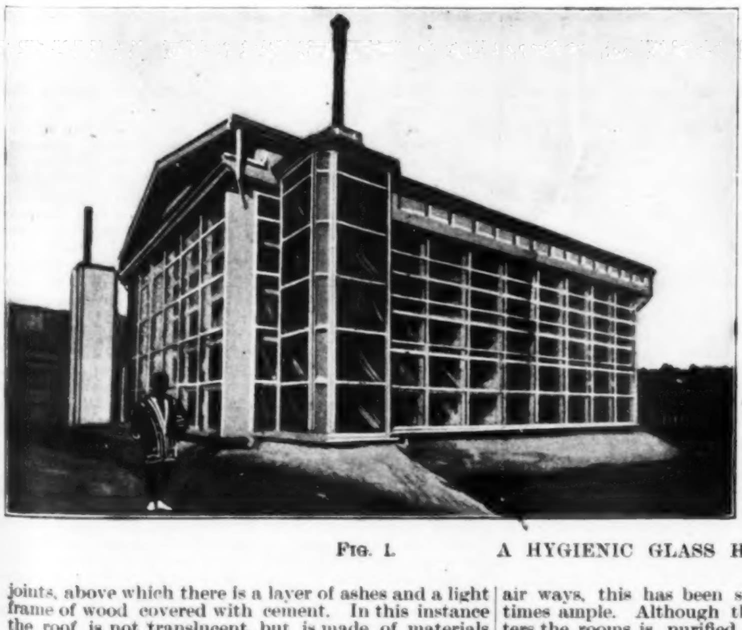
WHEN we take up a study, it is often impossible to foresee the end to which it may lead. The accurate determination of an atomic weight has resulted in the discovery of new elements. The observation that a magnet moved when suspended above a rotating copper disk was the germ of dynamos and motors. Investigations bearing upon movements which at times violently affect the earth's crust have carried us to the unfelt movements of the same, the subsurface precipitation of moisture, the action of stones as fertilizers, the transposition of plants, and to the study of phenomena of more direct importance to the farmer than the physicist. Bacteriology has led Dr. W. Van der Heyden, of Yokohama and Utrecht, to devise and construct a dwelling which he has described as "Eene Hygienische Woning." As a sanitary dwelling relatively to ordinary types of houses in which we exist to swallow vitiated atmosphere, sometimes hot and sometimes cold, it seems to possess many marked advantages. But its sanitary aspect is by no means its only title to recognition. Although the inventor of this new departure in house construction lays emphasis upon its sanitation, he also sees in it a means of shielding ourselves against extremes of temperature, of economy in the use of fuel, and a protection against the effects due to the more serious movements accompanying earthquakes. To us whose fortune it is to live in a country where the foundations of our buildings are not subjected to violent agitation, this latter feature in Dr. Van der Heyden's house possesses but small interest; but as this building was built in Yokohama, where it now stands in the grounds of the General Hospital, and since its erection in 1891 has already had to withstand about 300 shakings of varying degrees of intensity, that it should be earthquake proof became a necessary feature.

Although the writer is not able to give any minute details of this remarkable structure, inasmuch as he saw it when in process of construction and because the basement was kindly put at his disposal for the erection of instruments designed to show changes of level which might precede or accompany an earthquake, which instruments required isolation from great changes in temperature, the opportunities for studying its behavior and confirming the conclusions arrived at by its inventor were numerous.

Roughly the house is 44 ft. in length, 23 ft. in breadth and 17 ft. in height, and is built of glass. This glass is rough plate approaching ½ in. in thickness, and each wall is made of two layers of this material separated by a space of about 4 in., which space is filled with a strong solution of a salt-like alum or one of the commoner salts of soda.

To carry out this construction panes of glass measuring about 3 ft. by 2 ft. are fitted into two sides of a cast-iron frame to form a box. A number of these boxes are screwed together end to end, until a row the length of a wall has been formed. On the top of a row felt and boards are placed, above which comes row after row until the required height of wall has been reached. It was the original intention of Dr. Van der Heyden to construct the roof in a manner somewhat similar to the walls, but experience has shown that this is hardly necessary. The illustration, Fig. 3, shows the roof consists of glass plates with strips of rubber between the





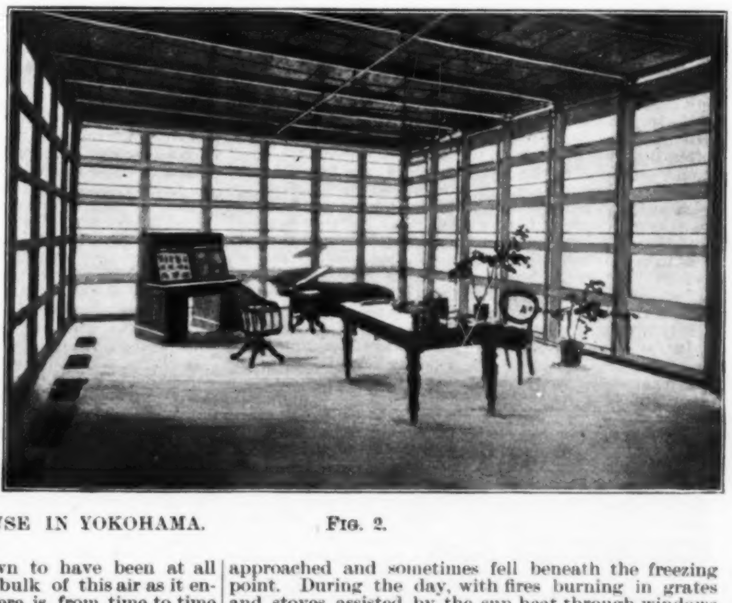


FIG. 1. A HYGIENIC GLASS HOUSE IN YOKOHAMA. FIG. 2.

joints, above which there is a layer of ashes and a light frame of wood covered with cement. In this instance the roof is not translucent, but is made of materials which are fairly impervious to the heat from the sun and to the escape of heat from the inside.

From this description the house is, therefore, a well-lighted box-like space without windows or doors. There are no openings, cracks, or fissures to admit air, moisture, insects, dust, or microbes, while the function of the walls in excluding heat and cold will be referred to presently. On account of the color of the solution in the walls, which color may be varied to suit taste or the requirements of experiments, the light in the room at the time of the brightest sunshine is diffused and pleasant. The floor of the room is made of double planks between which there is a layer of sawdust. In this floor there are grids for the admission of air and four large plates of glass which give light to a lower room which is partially underground. The entrance to the dwelling is by means of a corridor leading to the lower room and a staircase. Doors are so arranged in this corridor that but little air is admitted while a person is entering or leaving the building. Fresh air is obtained from a pipe or pipes which rise vertically above the ground at some distance from the house and communicate with a tunnel or pipes leading to the lower room. Before entering this room the air is filtered by passing through cages filled with cotton wool. As the air emerges from its filter it strikes a large pane of glass coated with glycerine, where the few microbes that may have succeeded in passing the net of cotton fiber are caught. By this means it is assumed that the air entering the room is as pure as an antiseptic dressing of Sir Joseph Lister's. From the lower room this purified air is allowed to pass through the regulating grids to the upper chamber, from which it is discharged around a space near the ceiling which in ordinary rooms is represented by a moulding. Running round the building on the outside and communicating with these air openings there is a belt-like chamber covered with ordinary window glass. Usually it is found that the heat in this belt is sufficient to cause a current toward a chimney also constructed to be heated by the sun. In connection with this chimney there is an opening for the rain which is discharged at its base to create a draught after the well-known manner of a water trompe. The general result is that the more the sun shines or the more it rains, the greater is the ventilation. When sun and rain fail, a small stove may be lighted to create the necessary current, but this has seldom been required. To obviate the effects of earthquakes, the upper building is carried on balls resting in cups; that is to say, it has a free foundation. From this imperfect description of Dr. Van der Heyden's somewhat costly and bold experiment, we will next turn to its working.

So far as ventilation is concerned, calculations based upon records obtained from anemometers placed in the air ways, this has been shown to have been at all times ample. Although the bulk of this air as it enters the rooms is purified, there is from time to time added to it a small quantity of ordinary unfiltered air entering with each person, who also, we presume, carries on his dress and body a certain number of the omnipresent microbes. These, however, because they come into a room bathed in light, without a single dark corner in which they can multiply and develop, are quickly doomed to extinction, especially in a chamber which lends itself to disinfectant sprays and washings. Whether this is absolutely so or not it is beyond the power of the writer to pronounce upon, but the fact that Dr. Van der Heyden finds that butter, milk, and other putrescible substances remain in a fresh state longer in his house than in ordinary dwellings indicates that a chamber in which the air, if not absolutely pure, approaches such a state, has practical advantages which appeal to the housekeeper. By placing catches partly similar to those before the openings through which air enters the house in the sun belt, and by other means, carbonic acid, organic alkaloids, the products of expiration and exhalation generally, dust and any impurities are deposited before the outgoing air passes into surrounding space. The arrangement for the oxidation of the unassimilated products of the human system and their conversion into nitrate of ammonia and other inorganic salts is also instructive. Dr. Van der Heyden evidently regards every dwelling, and especially hospitals, as possible foci of infection, and although it is highly important that these should be supplied with pure air, he considers it equally important that they should not be allowed to discharge anything in the form of liquid, solid, or gas which could possibly carry with it the germs of contagion. Even the water used for washing and that from the kitchen is rendered innocuous before it leaves this sanitarium.

We next come to a feature in the house which, to the minds of those who take little heed of dust and microbes, is suggestive of development along many lines for the economy of labor and of fuel. During one winter that Dr. Van der Heyden was living in his house, the writer, for the purpose of attending to his instruments in its basement, had often occasion to visit him, and during that winter he did not require to burn any fuel for heating purposes only. From time to time, however, during cloudy weather, a little fuel was used for the ventilating stove. The total amount for the season could not have exceeded half a ton, but whatever it may have been, after the addition of the "sun belt" the small consumption of fuel was practically reduced to zero.

In Mr. Van der Heyden's house no inconveniently low temperature was felt, while in adjacent houses on several occasions water froze in bedrooms. It may, therefore, be concluded that at night the temperature closely approached and sometimes fell beneath the freezing point. During the day, with fires burning in grates and stoves assisted by the sun heat through windows and glass verandas, the temperature of these same rooms rose at least to 60° F. The daily range in temperature experienced in an ordinary house in central Japan may, therefore, for the winter months, be taken at about 30°, and to attain the daylight temperature for say a couple of rooms, from 5 to 7 tons of coal are burned. The maximum range of temperature in the glass house, as shown by a self-recording thermometer, was less than 6·5° F. An experiment made in the house during freezing weather in January was to note the fall in temperature while the ventilating stove,

which is arranged to warm the incoming air, was extinguished. In 53 hours the fall was from 66° F. to 49° F., and as the surface of the house is 108 square meters, this represented a fall of $\frac{1}{2000}$° per square meter per hour.

The action of the building as a heat absorber and heat retainer is, briefly, the following: When the sun shines its heat, rather than passing through the glass walls to raise the temperature inside, as it does in a greenhouse, is taken up by the liquid they hold, and more salt enters into solution. At night, when the temperature falls and the liquid cools, there is a tendency for this extra quantity of dissolved salt to crystallize, and while crystallizing heat is given out. Because on the outside of the fluid walls there is an air space bounded by ordinary window glass, the escape of heat outward is minimized, with the result that the heat trapped during the day is given up to the interior of the building, which, unlike the greenhouse, cannot fall rapidly in temperature.

When the building might fall would be in the winter months, after three or four days cloudy weather. To meet this contingency it becomes necessary to light the ventilating stove, which might be of gas or petroleum, and warm the incoming current. In very many countries outside the British Islands, three or four winter days of continuous cloud are of comparatively rare occurrence; but even in Britain we have a few days of sunshine, and Dr. Van der Heyden shows us how to capture and utilize a portion of this heat. A plant house, for example, built after this plan, ought to be worked at less expense and with less trouble than one built in the ordinary manner and requiring artificial heat. From want of judgment, and often from carelessness, the omission to light a fire in a greenhouse is attended with results which ought not to occur in a house with a supply of heat within its walls.

In summer time what we looked for and obtained by throwing open windows and doors, the doing of which may be as often forgotten as closing them, is usually a reduction in temperature. In the Yokohama house the thermographic records show that this has been attained in a very marked measure. Although this house stands in the open, with its flat roof and walls exposed to 14½ hours of summer sun, not cooled by a sea breeze, not sheltered by trees, and not divided by sheltering walls in its interiors, these records have shown that day after day the temperature has never been above, and often been below, that of the most sheltered place that could be found in the neighborhood. In five ordinary houses, taking apartments considered to be cool and pleasant, the temperature in them was always found to be several degrees higher than that in the sanitary building. The explanation for this is that the fluid walls will take up the direct heat of the sun, while the air before it enters the building, because it passes through tubes underground, is reduced in temperature. In winter this latter arrangement leads to a slight rise in the temperature of the inflowing current.

In Japan the temperature of the air in summer rises to 80° and 95°, and is often loaded with moisture. In the glass house the temperature was fairly constant at about 74° Fahr. To reduce this 3° or 4° more and to get rid of the suspended moisture we understand that the air coming through the underground passages before it enters the lower chamber is passed to the bottom of a well which has been sunk in the basement.

In this imperfectly described experiment of Dr. Van der Heyden's we also see in addition to what we have described a building in which there should be a total absence of insect life. The man who lives in a warm country knows the pleasure of a room free from mosquitoes and other pests, which not only cause irritation by their noise and bites, but which in some instances have been the means of transmitting disease, while the absence of dust will always appeal to domestic servants. The variations that can be made in the forms of construction that have here been indicated are numerous. Should we, for example, only desire to capture sun heat, it possibly may be accomplished by two metal walls, carrying between them a solution of soda sulphate (?), the outside wall can at night time be covered with a layer of felt. Whether this is practicable or not, that sun heat may be caught within a chamber until it even causes the ebullition of water is realized in the heating box of De Saussure, while the house of Van der Heyden, however we may be pleased to vary it, shows that the conditions under which we ordinarily exist are capable of modifications attended with advantage. We are indebted to London Engineering for the cuts and copy.

WHEN DOES THE NEXT CENTURY BEGIN?

"The question is twofold," says the London Times, "what lawyers call 'a mixed question of law and fact,' and may be divided as follows: (1) What do we mean by a given date, say February 10, 1896—i. e., what theory do we hold as to the correct method of dating; and (2) how does our theory, whatever it may be, agree with actual usage? There can be no doubt that one person may hold that the next century begins on the 1st of January, 1900, and another that it begins on the 1st of January, 1901, and yet that both of them may be in full possession of their faculties. It is not a case for strong language, and cannot be settled offhand by the mere statement that 99 is not 100. Most people, however unskilled in arithmetic, will agree so far. The truth is, each view may be plausibly supported, for each view depends on a theory of dating which is in actual use. The color of the shield depends upon which side of it you are looking at.

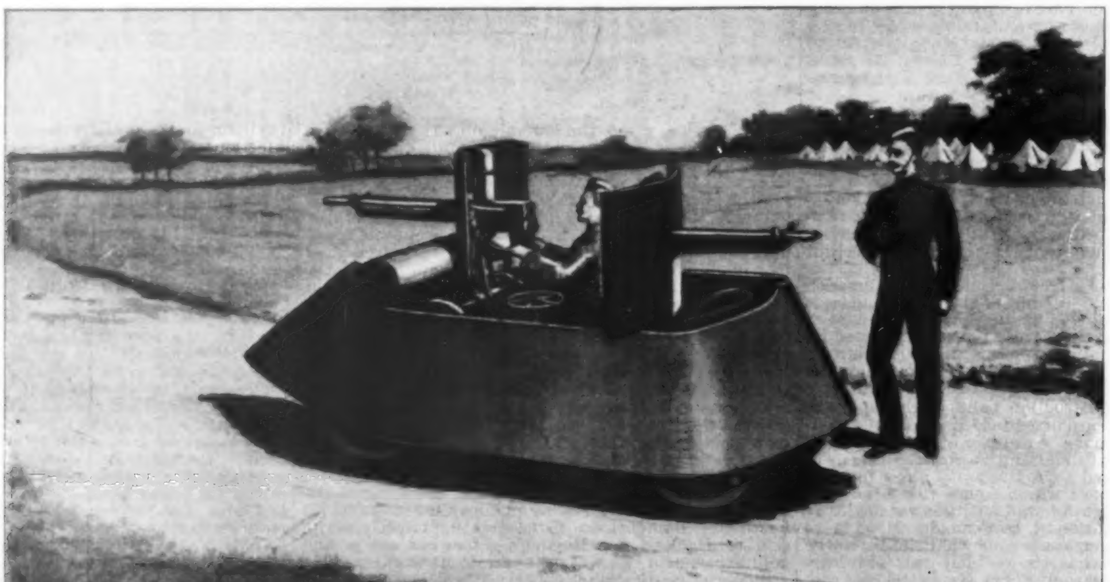
"Let us suppose a person to be writing a letter some eighteen months after the birth of Christ. How will he date his letter? Will he write, say, July 10, year 1, or July 10, year 2? If he writes the former, he will consistently hold that the next century begins January 1, 1900; or if he writes the latter, he will hold that it begins January 1, 1901.

"The first view is based on the theory that the time specified is one year six months and nine days (and some hours to be exact) after the birth of our Lord; the second view is based on the theory that the time specified is the second year, sixth month, and tenth day after the same event. According to the first view, February 10, 1896, means 1,896 years, one month, nine days (and some hours) after the birth of Christ, and we are consequently in the 1,897th year. According to the second view, February 10, 1896, means the 1,896th year, second month, and tenth day, and we are, consequently, in the 1,896th year. According to the first view, the number of the year is the cardinal number; according to the second view, it is an ordinal number. Both of these methods can conceivably be maintained, and, as stated above, both are in use. If we write a letter in the afternoon and wish to specify the exact time, we date, e. g., 4:30 P. M., which means four hours and thirty minutes after 12 o'clock. There we use a cardinal number. We might equally well write 'in the fifth hour,' but as a fact we do not so write. Again, in walking, as soon as you reach the tenth mile stone from a given starting place you have completed ten miles. So when a boy is more than twelve years old we say he is in his thirteenth year, and he does not have to wait another year before 'getting into his teens.' Again, in the Book of Common Prayer, the next century is referred to as the period 'from the year 1800 till the year 1899 inclusive.' All these calculations are based on the reasonable ground that in concrete reckonings of time and space we do not begin with 1, but with 0, and that there is the same space between 0 and 1 as there is between 1 and 2. The question then is, When we write 1896 are we using a cardinal or an ordinal number? It is clear that if we are using a cardinal number the last day of the century is December 31, 1899, while if we are using an ordinal number the last day of the century is December 31, 1900.

"Arguing then in vacuo, if we may so express it, one system is as good as the other, but the following considerations seem to lead to the conclusion that we used the number of the year as an ordinal number, and that consequently the century does not end until December 31, 1900: (1) In English we use the ordinal number in the day of the month, we say 1st, 2d, 3d, etc., and not 1, 2, 3, etc. The name of the month also is equivalent to an ordinal number, because by February, e. g., we mean the second month. It would thus be illogical to suppose that the year is a cardinal number when the month and day are ordinals. (2) If we turn the year into Latin, it is an ordinal number—viz., anno millesimo nonagesimo sexto. If it is objected that the Latin number may be ordinal and yet the English be cardinal, the obvious reply is that by this number the Latin means the same year as we mean by 1896 and not what we mean by 1895. (3) The parallel tables of years made by chronologists in comparing one system of dating with another make 1 B. C. followed immediately by 1 A. D. Thus in 'Zumpt's Annales' (to take a well known book) the year of Rome (A. U. C.) 753 corresponds with B. C. 1, and the next year 754 with A. D. 1. And this is, of course, not an arbitrary calculation of Zumpt, but he is merely carrying on the accepted mode of reckoning. Strictly speaking, A. D. (Anno Domini) is applicable only to this mode of dating, for if a cardinal number is used, it should be P. C. (Post Christum). On the whole, we may consider we are tolerably safe in holding that the next century begins on January 1, 1901, although great names may be quoted on the other side."

THE LATEST IMPLEMENT OF WAR.

The illustration represents one of the latest novelties in the line of war material; it has been designed and patented by Mr. E. J. Pennington, the well-known inventor, who has made such great strides in the autocar and motor cycle movement. The equipment consists of two rapid firing guns, mounted on an autocar. The autocar is driven by a 16 horse power engine, the wheels having four-inch solid rubber tires. The guns are on a swivel and are arranged to discharge at various angles, and they rotate automatically while they are being fired, if desired. The firing is controlled entirely by the engine which drives the autocar, and the guns may be fired while the autocar is in motion or when standing still. The ammunition is fired at the rate of from 50 to 700 rounds a minute. Each gun is supplied with 500 rounds of ammunition. The shields round the autocar are arranged so that an ordinary bullet from a rifle would not penetrate, as they are on an angle, and when these machines are in motion it will be very difficult for a large field piece to hit them. The great trouble in the past with rapid firing guns has been that it is not possible to fire them at varied speeds, and sometimes the entire charge is lost owing to this fact. Again, with a gun of the above type, should the operators be shot down, the engines would continue running, and would fire the entire charge of ammunition. A rapid firing gun is supposed to be a very good thing, provided you can come in contact with your enemy, but where you have a gun mounted on a fast running machine, which is capable of making forty-five miles an hour, it is quite an easy matter to get near the enemy. One can readily imagine what would be the effect if say fifty or a hundred of these engines of war were taken and charged into a large body of troops, or run through a city at a high rate of speed, firing their deadly missiles on to the inhabitants as they rushed through. We are informed that several governments are now negotiating with Mr. Pennington for these machines, and the outlook for their future appears therefore to be very bright. We are indebted to Industries and Iron for the cuts and particulars.



A NEW IMPLEMENT OF WAR.

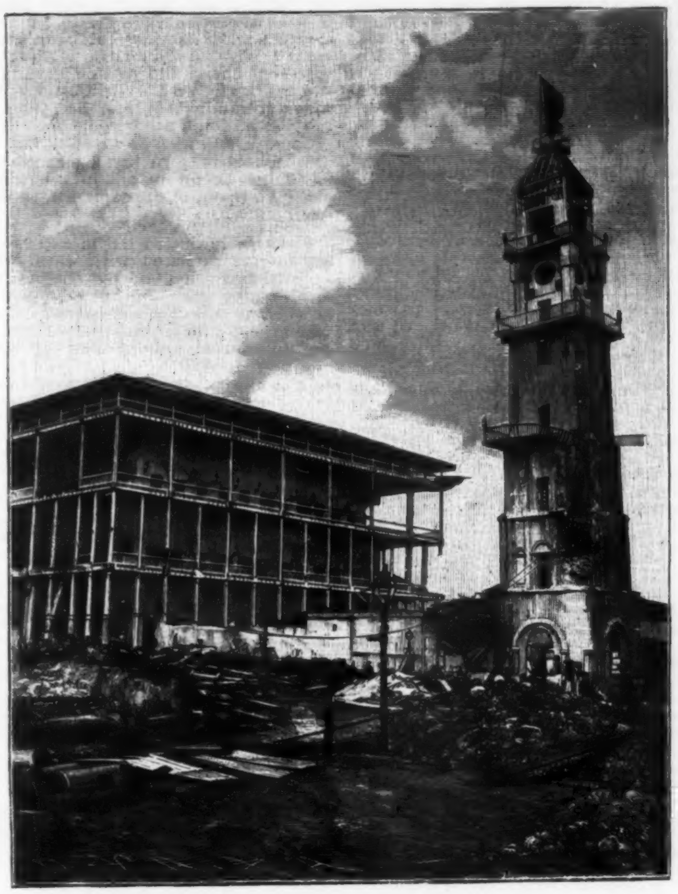
THE BOMBARDMENT OF ZANZIBAR.

If anyone should question the destruction which modern shell fire is capable of working in an incredibly short space of time, they should learn the lesson which was taught by such a scene as is shown in the accompanying illustrations. They were made from photographs which were taken on the spot, shortly after the recent bombardment of Zanzibar, and appeared in Illustrirte Zeitung, by whose courtesy we are enabled to present them to our readers.

In our issue of September 26 we gave an account of the Zanzibar dominions and the events which led up to the usurpation of Seyyid Khalid, who, it will be remembered, immediately upon the death of the Sultan, seized the palace and proclaimed himself ruler. He forthwith received an ultimatum from Admiral Rawson, of the St. George, one of a small fleet of cruisers which lay in the harbor, to the effect that if he failed to haul down his flag within two hours, or by 9 o'clock, the British ships would open fire. Promptly at the hour named, the rebel flag still flying, the guns of the

Raccoon bombarded the palace, and within the brief space of thirty-seven minutes it had been knocked into a state of ruin of which our illustrations convey a vivid impression.

The work of bombarding was mainly done by one small cruiser or gunboat, the Raccoon, of 1,770 tons, mounting six 6 inch guns, three on a broadside. When we bear in mind that the firing lasted only slightly over half an hour, and that only three of these guns could have been in action at once, it is evident that the destructive power of shell fire from a single 6 inch gun is enormous. It should also be borne in mind that the 6 inch guns of the Raccoon were of an old, slow firing pattern. The new rapid fire guns, with which the most modern cruisers are armed, have a rapidity of fire at least three or four times as great as the old slow firers. So that the ruin which was accomplished mainly by the broadside battery of the Raccoon could have been done by a single rapid fire gun of the latest pattern in the short space of thirty-seven minutes.



WRECK OF SIDE WING OF PALACE AND LIGHTHOUSE.

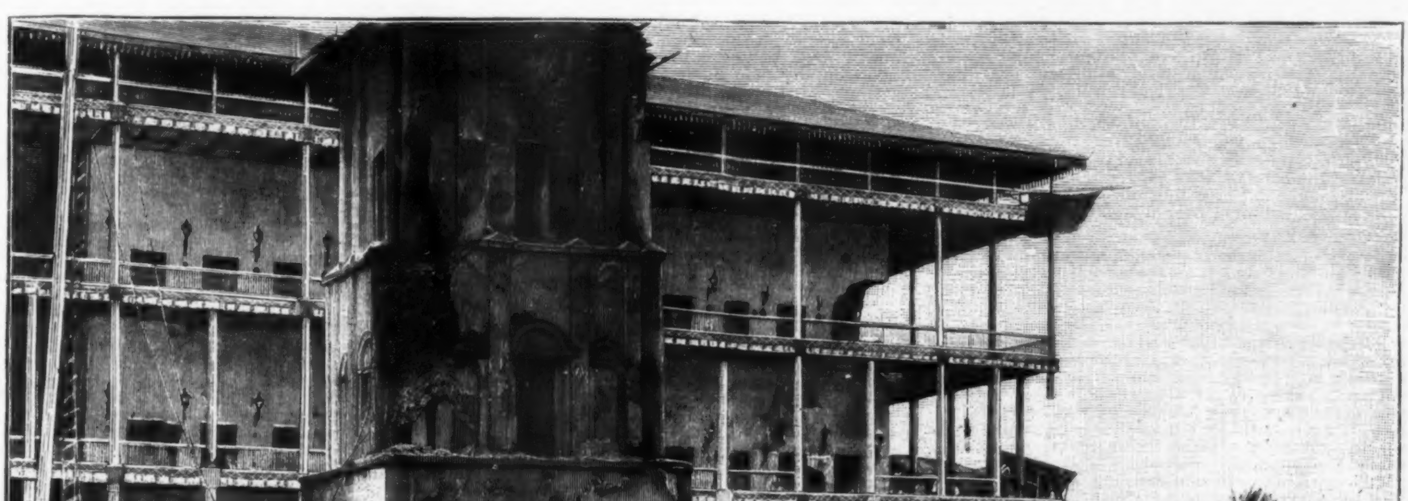
The 6 inch rapid fire gun on the Royal Arthur, a sister ship to the St. George mentioned above, has a record of eighteen aimed shots in three minutes, and as high as four rounds in twenty seconds at drill. If this rate of fire of six shots per minute could be maintained for the thirty-seven minutes without overheating, one rapid fire gun would in the time throw 222 explosive shells, weighing 100 pounds apiece, into a city—a rain of projectiles which would easily account for the complete destruction of the palace. The St. George, which does not appear to have joined in the shelling, carries five such guns on her broadside, and by extending the calculation, it will be seen that she could throw nearly a thousand 100 pound shells into a city in a brief half hour. In addition to this she would deliver some 120 huge shells, weighing 380 pounds apiece, from her 9·2 inch heavy guns.

It is interesting to calculate the bombarding power of a fleet of half a dozen such cruisers as the St. George (which is of 7,000 tons displacement, and not so large as the New York), say for a space of one hour. At the rate of fire above given, they would hurl into a city 9,000 one hundred pound shells and 1,200 three hundred and eighty pound shells, making a total weight of 678 tons of explosive projectiles.

It must, of course, be borne in mind that the little ship which destroyed the palace was unprotected, and could never have carried out the bombardment if the town had been protected by forts. This applies also to a fleet of half a dozen ships such as the above. Properly designed sea coast defenses, such as are all too slowly being built around our shores, would prevent the approach of any but heavily armored battle ships within range. But so long as our defenses are incomplete, we are open to attack by any class of war ship, armored or unarmored, which could approach within eight or ten miles of our undefended cities.

The type of ship that knocked the Zanzibar buildings to pieces in less than an hour is possessed by every state that owns a navy, big or little. To those people who cannot see the necessity for our ever recurring appropriation for sea coast defense, this fact and the object lesson afforded by the scene of wreckage shown in our illustration should prove a convincing argument.

Much confusion is caused by the prevailing careless way in which alterations are made in drawings; that is, when large or small alterations are made, it is the practice in but few drawing rooms to make proper note of the date of making the alterations; of the reasons for them, and of keeping a record of what was on the drawing before the alterations were made. Very often the original drawing or tracing is destroyed and new ones are made, and it frequently happens that the information contained on the destroyed drawing is afterward required. Important lawsuits or cases of interference before the Patent Office have been lost for the want of a proper record of changes which were made in drawings. It is the writer's practice to sign and date all sketches of devices and frequently to have them witnessed; and drawings are always dated and signed. If alterations are afterward made, even if in only one important particular, it is done first on a record print that is always preserved. The date of the alterations is entered on the record print and the original work and a record of it is thus preserved. In this way a complete history of each change is kept. The original date is always kept, even if new drawings and tracings are made. This is a simple and easy course to follow and it has proved of great value to the writer in many cases.—Railway Master Mechanic.



EFFECT OF BOMBARDMENT ON THE SOUTHEAST PALACE AND LIGHTHOUSE TOWER, ZANZIBAR, 1896.

ENGINEERING NOTES.

The Russian railroads made a fine exhibit at Nijni-Novgorod, including many appliances by Russian inventors. Nearly all the passenger cars were approximately of the American type, and most of them, even third and fourth class cars, were fitted to be used as sleeping cars. There was a great variety of special freight cars for carrying stock, racehorses, fish, fruit, milk and beer and hospital cars, including some intended for patients affected with contagious diseases.

The Pintsch system of car lighting has been adopted for the trains of the Manhattan Elevated Railroad, after a thorough investigation of the subject and in compliance with the requirements of the New York Legislature. The contract with the Safety Car Heating and Lighting Company was signed on December 1 and the cars must be equipped by April next. Gas works will be erected by the Pintsch Compressing Company, at One Hundred and Fifty-ninth Street and Eighth Avenue, from which the cars will be supplied.

The railroad companies of Lower Hungary are successfully making use of the Provence rose for hedges by the sides of the railways to protect the tracks from drifting snow. The writer, in imagination, pictures the scene of a "summer's journey gladdened by the glory of roses, shining to the right and left of a swiftly gliding steam chariot, while the surrounding atmosphere is fraught with faintly subtile scents which superinduce a soft languor in the fortunate traveler." Such an arrangement would outdo even the Michigan Central's happy custom of presenting its lady passengers with a bouquet culled fresh from its own wayside gardens.

For several years, says the Engineering and Mining Journal, the coal dust from the Emanuel Colliery, near Radlin, in the Ratibor Mining District, in Germany, was made up into briquettes in an unwashed condition; but on account of the high ash content, the management determined to employ washed coal dust, to be dried in special apparatus. For this purpose a plate oven, 6 m. (19¾ ft.) diameter, was employed, on to which the wet coal dust, already mixed with pitch, was delivered by an elevator. The drying was effected by an open fire, the heat and gases from which first pass over the revolving plate, and then under it into a flue, which leads the gases of combustion to the chimney. This contrivance, designed for turning out 300 tons of briquettes in 24 hours, has given good results.

The Oriental, sub-tropical kingdom of Siam, with an area considerably larger than that of the great State of Texas, and with a population of 6,000,000, has awakened to the desirability of railways, and the United States minister there writes that American investors, manufacturers and engineering experts may find it a profitable field of enterprise. He enumerates five proposed railways, each from 40 to 100 miles long, and says that short electric roads, water works, sewerage systems and other undertakings are needed. While it must be remembered that the English, German and Danish have the advantage of precedence in that country, it is not improbable that American enterprise in that direction might be rewarded. The minister of public works may be addressed at Bangkok.

The Cairo correspondent of the London Times says that "Mr. W. E. Garstin, in his report on the work of the Irrigation Department, says that 1895 was a red letter year for Egyptian agriculture. The chief crops were not only exceptional in yield and quality, but the prices, sugar excepted, ruled considerably higher than during several previous years. The present tendency is to increase sugar cultivation upon an extensive scale, and, with an improved water supply and greater facilities for obtaining manure, the yield can be very largely augmented. In ten years 1,400,000 acres have received drainage at a cost of £421,000, but there still remain 3,000,000 acres, which will require an expenditure of £800,000. Of the agricultural roads, 900 miles were completed at the close of 1895. Concessions for laying and working light railways in connection with these roads have been granted over five out of the six provinces of the Delta."

In the equipment of the gas engine railway at Blackpool, England, the engines are balanced, one cylinder being opposite, or 180 degrees, from the other, and are so arranged with regard to the gearing and governor that when on very easy going only one of the two cylinders receives a charge, and thus less work is done and less gas is used. When stopping, not only is one cylinder cut out, but the speed of the engine is brought down from the ordinary 260 revolutions, subject to the governor, to about seventy-five revolutions per minute, the gas supply and the speed of the governor being altered by the movement of the hand lever, which throws the friction clutch of the driving gear out of action. At the same time the lubricating oil supply is reduced, so that no smell arises from the excess oil supply, which, under ordinary circumstances, collects when the engine runs light. A very ingenious arrangement of the lubricator is resorted to for this purpose, by which its action is controlled.

The purification of drinking water by means of ozone has now been carried out on a large scale at Oudshoorn, Belgium, for over a year. The water source at this place was polluted, being, when untreated, absolutely unfit for use. At the first contact of the water and the ozonized air the greater part of the microbes are killed, a few, however, offering resistance, to kill which seven or nine minutes of continued application are required. A remarkable example of the power of ozone for this purpose is mentioned, namely, that of seventeen sample tubes thus treated, sixteen remained sterile. It has also been found that the ozonized water is very much less liable to reinfection than water which has been merely filtered, and that the beneficial salts in water are scarcely affected by ozone, while both the color and taste of the water are modified favorably. The only difficulty in the application of this process hitherto has been the want of perfectly constructed apparatus to produce the ozone economically and in large quantities—a difficulty lately overcome by Dr. Ropin's process. The method of treatment in question depends, in respect of cost, upon the amount of organic material in the water and the price of coal, so that, in the treatment of Seine water, for example, the expense is given as less than 1 horse power per hour for the sterilization of 5 cubic meters.

ELECTRICAL NOTES.

A Brussels firm is soon to equip Abyssinia with a telegraph system. The more important stations are to be connected with the imperial residence.

"**An electric** railway for passengers is proposed for Mont Blanc. Up to a certain altitude it would be upon an inclined plane, and the ascent would be completed by a vertical shaft of a depth of 2,539 meters, through which powerful electrical lifts would convey the passenger to the observatory on the summit. The question is, Would it pay?" This item, from the English Electrical Engineer, has been going the rounds of the electrical press.

A note in the Elek. Zeitung, says the Electrical World, gives the results of a speed test made on the occasion of the recent fiftieth anniversary in Belgium. In the course of one hour the following speeds were obtained: Morse sounder, 27 words per minute; with the telephone, 38; with the Hughes apparatus, 40; with the Morse transmission a number of different languages were used. Editorially it is stated that this gives an entirely wrong impression of the relative efficiency of the telephone, as with this method the speed is limited to that at which the message can be taken down, which is only a fraction of that which could be obtained with the telephone.

A note stating that an interesting application of accumulators has just been made in Paris on four lines is given in L'Industrie Electrique. There are 35 cars, each weighing 14 tons with passengers; the accumulators are never taken from the cars; the charge is sufficient for a return trip, which represents about 12 to 15 km., and the accumulators are recharged in 15 minutes at the terminal; the cars will seat 52 passengers; there are 200 Tudor cells of five plates each, the plates weighing 15 kg., and the entire battery complete 3,600 kg.; the speed is limited to 12 km. per hour in the city and 16 outside; the guaranteed capacity is 32·5 ampere hours; the charging is done at 120 amperes.

Electric traction is about to replace steam on the Upper Silesian Railway, at least as far as the two following sections are concerned: Gleiwitz, Zabrye, Koenigshuette, Beuthen, Deutsch Piekar; and Koenigshuette, Kattowitz, Laurahuette and Koenigshuette. The combined length of the two lines is about 33 kilometers (20½ miles) and the gage 785 mm. (2 ft. 7 in.) The whole of the installation, we are informed, is being carried out by Messrs. Felix Singer & Company, Berlin, who are the representatives of the Walker Company. The motor cars are mounted on two swivel trucks, each of the four axles of which will be driven by a street railway motor of 18 to 20 horse power.

It is anticipated that in five years time Japan is likely to possess the most perfect telephonic system in the world. There is already a considerable nucleus in existence, but the decision of the Japanese government to appropriate a sum of $64,000,000 in the expansion of the service, spread over a period of seven years, will soon make itself evident. The work of construction is being rapidly carried out at various important places, the intention being to complete by March, 1898, the expansion of the service relating to Tokio, Osaka, Yokohama, as well as the new constructive work in Nagoya, Nagasaki and Shimonoseki, and to establish a telephonic connection between Tokio and Kobe.

At Montreux, in Switzerland, the electric tramway gets its power from a very small stream, and from the old Roman town of Vevey to the mediæval castle of Chillon one may ride in a trolley car propelled by the power of an insignificant little stream. The capabilities of this general utilization of natural power are beginning to be understood everywhere, and with the appreciation of the possibilities of the best methods of long distance transmission, the development of many mountain streams must surely come. There are innumerable streams which, while very small, are yet very high, and these can, with comparatively little difficulty, be impounded and carried down many hundreds of feet, thus making up for their lack of volume by the great pressure readily obtainable, and, either by the use of electricity or compressed air, the power may be transmitted to many points of application with but little loss.

The announcement is made that the New York, New Haven & Hartford Railroad will take steps immediately to equip its short lines near Hartford with the third rail electric system. A big power house will be built at Berlin, ten miles south of Hartford and it is said that electric cars will be run by February. The electric system will also be put in on the New England road, between New Britain and Hartford, and cars will be run between New Britain and Berlin and New Britain and Hartford. The distance is about twelve miles from Hartford to New Britain, and a fifteen or twenty minute schedule will be possible. This move on the part of the steam road is said to be an effort to head off an electric street railway between Hartford and New Britain. Efforts have been made to build it, but so far the steam road has succeeded in blocking the project in the courts. Work will be begun at once on the equipment of the third rail system.

Recently the new electric light plant at the Capitol in Washington was started and proved to have been successfully installed. Work has been pushed for weeks on the new plant, which is the largest and most complete the Capitol has ever owned. The engine is of the compound condensing type, directly connected by a spring coupling with its dynamo, which rests on the same bed. This bed is 19 feet 6 inches long and 6 feet wide, a solid mass of iron weighing 20,000 pounds, and anchored with great bolts to a cement foundation 7 feet deep and weighing 98 tons. The engine itself weighs 19 tons, the dynamo 12 tons and the spring coupling wheel 8,000 pounds. So completely is the engine under control of its governor that there was a variation of only two revolutions a minute between the engine at full speed with its full load and at full speed with no load at all. From the engine room go twenty different leads, which will supply all the lights at the Capitol and grounds. These are 148 arc lights and 2,000 sixteen candle power lamps, with room and capacity for an additional thousand lamps if required.

MISCELLANEOUS NOTES.

It is worth remembering, especially when staying at hotels, that if the bedclothing is not sufficiently warm, two or three newspapers spread between the blankets will insure a comfortable night.

The Scottish Leather Trader, in an article concerning the dwarf or saw palmetto, which grows so abundantly in some of our Southern States, predicts a great future for the leather industry in this country. The Trader says: "With an abundance of raw hides of its own, with such cheap and prolific tanning material as the saw palmetto, with a delightful climate, with ample room for hundreds of tanneries, there is no reason why the South should not become one of the largest leather producers, and with its manifold advantages it will be able to hold its own in all emergencies. It offers to-day a most promising and inviting field for enterprise and investment to the capitalist, as well as to the practical tanner."

Brick work constructed in cold weather, using ordinary mortar prepared with warm water, proves very unsatisfactory in point of resisting power; nor is any improvement effected by dissolving in water ½ per cent. of calcium chloride. Excellent results are obtained when the mortar is produced with warm water containing in solution 1¾ per cent. of common salt. The addition of freshly slaked lime to ordinary mortar results in a satisfactory degree of durability; but still better results are obtained by the exclusive use of freshly slaked lime, especially when employed in conjunction with calcium chloride. An admixture of Portland cement with common mortar increased its resisting power to frost.—Thon Industrie Zeitung.

A compendium published by President Schurman, of Cornell University, shows that during the college year 1895-96 ninety-one officers of the university printed 495 books and magazine articles. Religion is represented in President Schurman's "Agnosticism and Religion;" literature in Professor Corson's "The Voice and Spiritual Education;" law in Professor Huffcut's "Elements of the Law of Agency;" science in Professor Tarr's "Elementary Physical Geography," Professor Bailey's "Survival of Variation," Professor Titchener's "Outline of Physiology," etc.; languages in Professor Bennett's two volume Latin Grammar; and so on through the list of educational interests. Such a list gives an idea of the great activity in our educational circles which is food for thought.

President Cleveland will shortly formally open at Philadelphia the most remarkable institution of its kind in existence—a museum which is designed to contain an assemblage of the natural and manufactured products of all countries of the world. Its object is to stimulate commerce and American trade, particularly with South America and Africa. All parts of the United States are interested in the enterprise, to which contributions have been made in one shape or another by cities north, south, east and west. The idea is that anybody who has anything to sell shall be enabled to find out offhand just where and how it is wanted, and the best way to seek the purchasers anywhere on the globe.

A portable asphalt plant has been built by the Hetherington & Berner Co., of Indianapolis, for the purpose of preparing asphalt for paving work in small cities where it would not pay to erect a stationary plant. The apparatus consists of two cars having steel frames and corrugated iron sheathing. Packed in one of these is a frame made of tubing and light steel beams, which forms the framework for the machinery when the plant is in use. The cars are run on a sidetrack and have the wheels blocked, the framework is erected and the mixer mounted in position on a tower between the cars. One car carries the power plant, consisting of a locomotive boiler and a steam engine. This car also contains the sand drier and screens, while the other contains the asphalt kettles.

For shop use, the regulation blue print, with its blue background and white lines, probably serves the purpose better than any of the variations which are occasionally used, as it shows the dirt, due to handling, less than the white background, with either blue or black lines. For office use, however, or for places where a "picture" effect is desired, the blue lines on a white ground are preferable, and would be used much more were it not for the trouble of making them by the usual process, which requires a specially coated paper and a chemical developing, both operations being similar to developing a dry plate. There is a concern in Chicago, however, making a specialty of blue print, who have adopted an ingenious and simple plan for producing "blue line" or reverse prints. They first make a regular blue print from the tracing on a thin bond paper, and using this as their tracing or negative, take the blue prints from it in the ordinary way, producing, of course, reverse or blue line prints, which are clear and clean in every way.—Machinery.

The split nails of Fenderl resemble in their general shape ordinary nails, says the Trade Journals Review. But the pin is split about half way up, the point becoming an M of straight or curved outline. To insert the nail, a hole is bored as deep as the solid portion of the nail, which is then hammered in. The operation requires a little practice, but is quickly learned. The split ends bend more and more apart. It is evident that such a nail would take a much firmer hold than the common type, and that the hold would always remain elastic. According to a report by Colonel Tilschkert in the Mittheilungen des Artillerie und Genie-Wesens, the nails stick well even in wood that has shrunk considerably. The removal of these nails is of course less easily effected than in the ordinary case, and necessitates a special, though simple tool; a nail taken out can be re-used, and the wood does not suffer any particular damage. This is, in fact, one of the chief advantages of the new nails—that pieces can be joined under an angle with or without the help of laths, etc., in a way which common nails did not permit. The rails of two Austro-Hungarian railways are being fixed by means of Fenderl's nails; Colonel Tilschkert has also found them useful for mounting guns. Clamps of the same type are manufactured.

SELECTED FORMULÆ.

Coryza Cures.—From a recent work of Dr. Lermoyez (Traité de thérapeutique des maladies des fosses nasales) we select the following, which are highly recommended:

FOR ABORTING A COLD—LIQUID.

Carbolic acid, pure	5 parts
Ammonia water, strong	5 "
Alcohol, 90°	10 "
Distilled water	15 "

Mix. Directions: Pour 10 drops of the liquid on a bit of white blotting paper of the size of the palm of the hand. Lay it flat in the palm, and placing it near (but not in contact with) the nose, inhale the escaping vapors for several seconds. Repeat at intervals of one hour.

ABORTIVE POWDER.

Cocaine hydrochlorate	5 parts
Menthol	3 "
Salol	50 "
Boric acid	200 "

Mix, and make an impalpable powder. Label: "Snuff a good strong pinch into the nostrils every hour or so."

This is an especially good formula, as the writer hereof can testify. Every "pinch" produces an abundant flow of mucus, and gives the greatest imaginable relief. If it does not break up the cold (which, however, it will do every time, when taken early), it gives so much relief that it is sure to become a favorite with your customers.

To accompany the powder, for the purpose of establishing permeability of the nostrils, when tightly clogged with mucus, a small bottle of a 1 per cent. solution of cocaine hydrochlorate might be prepared. The directions to accompany this should be: "Set in a vessel of hot water for a few moments, and when tepid, spray the nostrils with it, using a spraying apparatus with a nozzle of sufficient length to pass into the nostril a short distance." This brings a prompt discharge of the indurated mucus, and affords great relief to the patient. It should be repeated every three or four hours, according to the urgency of the symptoms.

CORYZA SNUFF.

Hydrochlorate of cocaine	5 parts
Powdered camphor	50 "
Quinine sulphate	50 "
Bismuth salicylate	50 "
Powdered starch	345 "

Mix and make a smooth powder. "Use every hour or two," snuffing well up into the nostrils.—National Druggist.

Waterproof Glue.—Sandarac and mastic (of each 231 grains) are dissolved in a pint of alcohol mixed with 231 grains turpentine and heated to boiling. The solution is then added gradually to a hot concentrated solution of equal parts of glue and isinglass, stirring meanwhile and until a thin paste is formed that can be filtered and used like ordinary glue.—Pharm. Centralh.

To Gloss Prints.—Give the glass a good washing with soap and water (using an ordinary nail brush); when thoroughly clean rinse under the tap. Now take a print (which must have been soaking in a dish of clean water for three or four minutes), place it face downward on the glass, and squeegee. When partly dry, mount a piece of backing paper on print, then set up to dry. It is not necessary that the prints should have been through an alum bath, provided they are not put on glass direct from the washing water. They must be allowed to dry first, and then damped just before putting on glass, as the film is too soft after being one or two hours in water. After standing on a mantelpiece for about three hours, the prints will leave the glass without any trouble, and they will have a gloss free from marking caused by small particles of chalk, etc., sticking to glass.—Amateur Photographer.

Preserving Bodies in their Natural Form and Color.—The following preservative fluid is employed by G. E. Wiese: 600 grammes of sodium hyposulphite dissolved in 5,000 grammes of water and 75 grammes of ammonium chloride dissolved in 250 grammes of water. The two solutions are mixed together and added to 4 to 6 liters of spirits of wine. The bodies of the animals to be preserved are simply immersed in the above preparation; and it is claimed that they will retain their original form and color for almost an unlimited period.

Powdered Wax for Ball Room Floors.—

Spermaceti	1 part
Powdered talc	3 "

Powder the spermaceti with alcohol methylated spirit and mix with the talc.

Black Ink for Typewriter Ribbons.—

Oil soluble aniline, black	5 parts
Crude oleic acid	6 "
Castor oil	94 "

M.

Blue—

Oil soluble, blue	3 parts
Crude oleic acid	6 "
Castor oil	94 "

Violet—

Oil soluble, violet	3 parts
Crude oleic acid	5 "
Castor oil	95 "

Rub the colors with the oleic acid, add the castor oil and warm gently till a solution is formed.

How Newspaper Pictures can be Transferred.—Prepare a liquid by dissolving 1½ drachms common yellow soap in 1 pint of hot water, adding, when nearly cold, 3½ fl. ounces spirits turpentine, and shaking thoroughly together. This fluid is applied liberally to the surface of the printed matter with a soft brush or sponge (being careful not to smear the ink, which soon becomes softened) and allowed to soak for a few minutes; then well damp the plain paper on which the transfer is to be made, place it upon the engraving and subject the whole to moderate pressure for about one minute. On separating them a reversed transfer will be found on the paper.

CHROM-AMMONIUM SALTS USEFUL IN PROCESS WORK.

By CuZn.

THERE is nothing new to add concerning the chromate and bichromate of ammonia, but there are three other compounds which the writer has used commercially—in everyday work—which are of interest. Practical workers will agree that the more chromic acid and the less alkali in a sensitizing solution, the quicker does such a solution print, but it decomposes the more readily on keeping if made with an organic compound such as albumen or fish glue. Those to whom this fact is new can readily prove for themselves that a fish glue sensitizing solution containing ammonium bichromate and no free ammonia prints out in a third of the time a strongly ammoniated solution would take, and that the former solution begins to decompose within a few days of its being made, while the latter keeps sound for weeks and months. The salts of chromium and ammonium which have been tried are as follows:

Ammonium chromate, $(NH_4)^2 CrO_4$; citron yellow crystals. Formed by neutralizing chromic acid, CrO_3, by ammonia and evaporating at below 60° F., or by double decomposition of barium chromate and ammonium sulphate—

$$BaCrO_4 + (NH_4)^2SO_4 + Aq = (NH_4)^2CrO_4 + BaSO_4 + Aq.$$

This salt gives off ammonia at ordinary temperatures. Readily soluble in cold water. It is in solution when a printing solution sensitized with the bichromate is neutralized with ammonia. Ammonium bichromate, $(NH_4)^2Cr_2O_7$. Formed by adding the proper quantity of chromic acid to ammonia; orange colored crystals. Solubility in cold water, 9 per cent.; in boiling water, 42 per cent. If a solution be evaporated down to crystallize and is not set aside when a crust begins to form, it may happen that the last trace of water is driven off before the operator is aware of the fact, with the result that if the temperature is at all high, the salt begins to smoulder, little red sparks running through the mass and leaving in their wake the flocculent green chromic oxide. The third salt, of which the writer does not know the exact composition, is formed by adding ammonia to chromic acid and boiling the solution till only a faint trace of ammonia is given off. This salt is of a brilliant brown color and crystallizes in very thin plates. It is permanent in the air, and does not effloresce. It is freely soluble in cold water, 12 per cent., and when used in albumen is quicker printing than the orange bichromate. A solution of ammonia bichromate in albumen neutralized with ammonia is of a brilliant yellow. On the other hand, the above brown salt in albumen, when made alkaline with ammonia, is of a brownish yellow.

The fourth salt of this series is the ammonium chromamate, $(NH_3)^2Cr_2O_3$. Formed by the partial saturation of chromic acid with ammonia, evaporation and crystallizing. It is a hyper-acid salt, crystallizing in brown yellow ill-defined crystals, which are very efflorescent. This may be due to water of crystallization being given off, or, on the other hand, to part of the ammonia in combination leaving the salt on exposure to air. The writer is of opinion it is the latter, for reasons to be shown later.

The fifth salt, though possibly identical in chemical composition with ammonium chromamate, seems to be worthy of possessing a name and formula of its own. This salt is the efflorescence on the crystals of ammonium chromamate. By the qualities of this salt the writer thinks that it contains less ammonia than the chromamate. In solution with albumen it is of a brown color, and when alkalinized with ammonia still presents a dark brown appearance, though there is a change in the color itself. Without free ammonia it is the quickest printing salt of the five mentioned. As the speed increases with the increase of acid in the first four salts, it is more than probable that the fifth is more acid, that is, loses ammonia in parting from its parent salt, the ammonium chromamate.

Working on this idea, the writer is trying two higher salts—ammonium trichromate

$$(NH_4)^2Cr_3O_{10},$$

ammonium hexachromate

$$(NH_4)^2Cr_6O_{19},$$

and if successful in practice, will publish the results. They may prove, however, so acid as to decompose spontaneously in contact with albumen or fish glue.

Of the other chromates, bichromates and double chromates (such as those of the metals and alkaline earths), the writer has found one extraordinary one, details of which will be published when the long series of experiments is finished. This particular salt is in use at present in CuZn's work, and for speed in printing has not been excelled.

Five per cent. of the salt in fish glue and water—half and half—requires for printing in the dark room on copper under an ordinary half-tone negative, two feet of burning magnesium wire held at six inches. Equivalent to about six seconds of full summer sunlight.—Photogram.

VISCOSITY OF LIQUIDS.

IN the Bakerian lecture for 1894 the authors, Dr. T. E. Thorpe, F.R.S., and J. W. Roger, gave an account of their work on the viscosity of some seventy liquids, and they discussed the interdependence of viscosity and chemical composition. The conclusions relating to the graphical representation of the results may be thus summarized. Both ethers and esters give no evidence of molecular aggregation, and conform to the rules that: (1) In homologous series the viscosity is greater, the greater the molecular weight. (2) An iso-compound has a smaller viscosity than a normal isomer. (3) The more symmetrical the molecule of an isomeric compound, the lower is the viscosity. As regards the esters themselves, it is noteworthy, where the comparison is possible, that: (4) Of isomeric esters, the formate has the larger viscosity. As regards the algebraical representation of the results, it is shown that in the expression $\eta = C/(1 + \beta t + \gamma t^2)$, derived from Slotte's formula: (1) In any homologous series, β and γ increase as the molecular weight increases. (2) Of isomeric compounds, the iso-compound has the smallest coefficient. (3) Ethyl ether, the symmetrical isomer, has smaller coefficients than methyl propyl ether. (4) As regards normal isomeric esters, the formate has the largest, and the propionate the smallest coefficients, and the values of the acetate are larger than of the butyrate. The authors then deal with the relationships existing between the various viscosity magnitudes — the viscosity coefficient, the molecular viscosity, and the molecular viscosity work: (1) At the boiling point; and (2) at temperatures of equal slope, the slope adopted being that employed in their previous paper, namely, 0·0,323, and values for the oxygen in three different conditions are given for each system of comparison in the same manner as in their first communication.—The Engineer.

TEMPERATURE LIMIT OF LIFE.

"AT what limit of temperature does life cease on our planet?" The question is propounded by Henri de Parville in Causeries Scientifiques, and answered as follows, as translated in the National Druggist: "For a long time we believed that life of any description ceases at between 50° and 60° C. (122°–140° F.), but in the solfataras, or hot sulphur springs, of the Pyrenees, some filamentous algæ have been found thriving at 61° C., and this is not yet the extreme limit. M. Miquel, of the Montsouris Observatory, has reported a living organism, the bacillus thermophylus, found at a temperature of 70–71° C. (160° F.) Now comes Van Zeighem and reports another micro-organism which thrives in water at a temperature of 74° C. (165° F.), and M. Glabig has found several analogous organisms. Finally M. Th. Schoesing, Jr., who reports that in making some investigations as to the heat developed by decomposing dung piles, he found a putrefaction ferment in intense activity at a temperature of 167° F., and that the activity of this ferment does not cease until 80° C. or 177° F. At this temperature egg albumen and serum coagulate. Should the palm of the ordinary man's hand touch a piece of metal heated to this degree, a bad burn would be the result. On the other hand, the experiments of French physicists have demonstrated that trichinous ham, which had been submitted to a temperature far below zero for several hours, when cut and thrown into warm water, developed the trichina in a lively state. The experiments of Cailletet and Pictet show that microbian vitality continues and life may be resuscitated after undergoing temperatures as far below the freezing point as the above cited instances are above it; so we know that life on our planet has a range of at least 150° C., or 270° F."

CHANGES IN THE BRAINS OF THE NON-INSANE.

IN the recently issued volume of the Edinburgh Hospital Reports, Dr. Robert Hutchison publishes a paper on this subject. It is obvious, as he says, that if the pathology of insanity is to be placed on a secure basis, the appearances presented by the cortical cells in a normal human brain must be first studied. And by normal is here meant average and not ideal, for the tendency has been too much toward setting on a pinnacle a nerve cell which corresponds to the notions of what a healthy nerve cell should be and making it a standard. The notions of what constitutes such a nerve cell are derived from various sources, but chiefly perhaps from the examinations of the cells in the brains of lower animals, and such a nerve cell obviously is too high a standard with which to compare the cells in the brains of those who have died from disease—not necessarily in those cells themselves—and the alienist has been too ready to assume that any abnormal changes which he finds in the cortical cells after death must have had some causal connection with the mental state of the patient during life. Such a deduction is of course unjustifiable unless it can be shown that such changes are only present with the abnormal mental state. The only way to correct erroneous impressions as to what a normal cell is will be to examine a series of brains of persons dying from general diseases who have never suffered from insanity. Such an investigation Dr. Hutchison has undertaken for one method, viz., the fresh method of Bevan Lewis. The method used was as follows: The portion of the brain examined in each case was a part of a convolution from the left motor area, the left ascending frontal convolution being most usually selected, and this was treated in the usual way. Fifty brains were examined, and the most striking fact was the frequency with which pathological changes occurred. Pigmentary degeneration was by far the most frequent of these changes, and in nearly half the cases there was distinct evidence of excess of pigment. Typical granular degeneration was not often found. True vacuolation of cells was also found, but Dr. Hutchison thinks that the nucleoli, which stain faintly by Bevan Lewis' method, have in many instances been mistaken for vacuoles. Changes in the neuroglia did not appear to occur so frequently in the sane as in the insane, and marked hypertrophy of "spider" cells has not been encountered. In no case were any changes found similar to those occurring in general paralysis. Speaking generally, the changes found in the brain cells of the sane are the same in kind as those found in the cells of the insane although widely different in degree. The various influences which might artificially produce changes in the cells are also considered. The method might produce some of the changes, but only a few, and these unimportant. The time after death at which the examination was made might also be regarded as of importance, but in sections made at once, and in others two or three days later, the brain being simply kept cool and moist, no difference could be detected. The most natural explanation of the changes is probably that they are secondary to disease elsewhere, and may be analogous to changes occurring in, e. g., liver cells in various morbid conditions of other organs. It will be recognized that this paper is a record of most important and interesting work. It raises the whole question whether there is a histological basis for the pathology of insanity. If experiments with other methods furnish similar results to those obtained by Dr. Hutchison with Bevan Lewis', it will be necessary to show that the morbid changes in the cells occur with much greater frequency and intensity in the brains of the insane than they do in those of the sane, if it is to be shown that there is such a histological basis for insanity.—Lancet.

ANCIENT POMPEIIAN BOILERS.*

By W. T. BONNER, Cincinnati, O., Member of the American Society of Mechanical Engineers.

IN preparing a recent paper on "Water Tube Boilers," read by the writer at a meeting of the General Mining Association, of Quebec, several newspaper accounts were noted descriptive of some very interesting relics discovered among the ancient ruins of Pompeii. As two or three of these relics showed unmistakable evidence of having been utilized as boilers in some form or other, my curiosity prompted me to extend my investigations further, with the result that I am able to present to this society what may be considered abundant proof that the water tube principle, the crowning feature of the most successful boilers of to-day, was fully understood and appreciated by the Greeks and Romans two thousand years ago.

In the center of the first hall in the National Museum at Naples, containing the bronze relics of Pompeii, are preserved two apparatuses for heating water, and numbered in the museum inventory 73,018 and 78,673.

A description of the above apparatus, together with photographs and drawings fully illustrating their detail construction, has been furnished me by M. Francisco Milone, a Neapolitan engineer of considerable reputation, at the request of the directors of the National Museum, to whom my communication to the minister of public instruction was referred. Reprints of these drawings and photographs are presented herewith, and from them it will be seen that there is a remarkably close analogy between the ancient Pompeiian boilers and the water leg boilers, water grates and water tube boilers of to-day. Indeed, the principle may be said to be identically the same in both, for little change would be required to construct from the drawing shown in Fig. 2 a very efficient boiler for high pressure work. Inasmuch as the ancients had little or no use for steam under pressure, and as their boilers were principally used for heating water, it was sufficient that the boiler shells and covers offered only a slight resistance, requiring merely a heavy, well fitted cover, which was sufficient to prevent the escape of the steam.

The first apparatus (No. 73,018), illustrated by the photograph, Fig. 1, and the drawings showing vertical and horizontal sections (Figs. 2 and 3), consists of a cylindrical receptacle, A, which measures thirty centimeters in internal diameter and forty-two centimeters in height. The thickness of the walls is a little more than a millimeter, and as one does not see any joints in the sides of the cylinder, it may be supposed that it was cast, as were generally all of the Pompeiian vases, and then worked or turned all round to even the thickness. The top of this receptacle was closed by a beautifully engraved or chased lid, B, which was removable, but neatly fitted over a bronze reinforcing ring, C.

At the bottom of the external cylinder it is joined to an internal cylinder of smaller diameter, and which rises to a certain height, and terminates in a spherical cap. The diameter of this internal shell is twenty-five centimeters and the height thirty centimeters. The annular space, or jacket, between the cylinders constitutes the water capacity of the boilers, while the interior of the inner cylinder constitutes the furnace chamber, the grate for which forms a very interesting feature of the construction. A careful examination of the particular boiler illustrated herewith shows that the annular water space does not preserve the same thickness all around, especially the oven, due more to having been damaged than to imperfect construction. Neither is the furnace chamber exactly central to the boiler. It is clear, however, that all of the surface of the inner chamber constitutes the heating surface in this Pompeiian apparatus, the same as in our water jacket boilers of the present day. The grate bars (see Figs. 2 and 3), seven in number, were made from sheet bronze, rolled and soldered or brazed. These tubes open at both ends into the bottom of the water jacket, thus forming water tubes, or grates, upon which rested the fuel, and through which traversed the water as it circulated in the boiler.

To quote from the description furnished me by Mr. Milone: "By this arrangement of the grates not only was the heating surface greatly increased, but the heating was rendered more efficient, thus showing that the ancients fully understood the principle of distributing across the furnace a certain number of tubes, in order to increase the heating surface, and to aid the evaporation by means of a more active circulation of the water."

The rectangular opening through which the fuel was fed was placed five centimeters above the bottom of the boiler, and is one hundred and twenty millimeters in height and one hundred millimeters in width. This opening was provided with a small door made of bronze hung on two vertical hinges, the door being operated by a bronze knob or handle, representing a ram's head. There is no evidence that these Pompeiian boilers were connected to a stack or chimney; but little annoyance was caused by the escape of gas or smoke, as the Pompeiians used charcoal as a fuel, the real "carbo" of the Latins. In order to permit the escape of the gases, at the height of one hundred and forty millimeters from the bottom of the boiler, there were provided three openings from the combustion chamber to the outside. These were formed by tubes which crossed the annular zone, or water jacket, and terminated at the outer end in a masked face, as may be seen on the left side of the photograph.

It is interesting to note here the artistic turn of mind of the ancients, for no matter how simple or how ordinary might be the article under construction, it seemed to be second nature to them to ornament every detail.

The cover, B, referred to above, is made of cast bronze, decorated in a very artistic manner, and can be removed and put in place by means of two small handles, each one gracefully representing two athletes wrestling, as is shown by the photograph, Fig. 1. The cover of the boiler is made in two parts, the larger of which was probably only removed in case of making internal repairs, or for the purpose of cleaning the boiler. There is a supplementary lid, F, much smaller, that opened on hinges, shown in Fig. 2, and it was through this opening that the water was poured into the boiler. The hot water was extracted by means of a big ladle with a long handle, or a pan or vessel. This second lid or cover had in the center a knob that represented an "Eros" or Cupid, entwined with a dolphin, having in his left hand a lyre and in the other the "plettro," or bow.

Finally, the boiler is raised thirty centimeters, on an artistic tripod representing lion's claws, thus allowing the entrance, below the grates, of the air necessary for the proper combustion of the fuel. Two handles that are attached to the outer shell of the boiler take the form of a man's hands, and serve to lift the entire boiler with the tripod.

As near as can be ascertained, the above boiler was found in Pompeii proper, but my informant is not able to indicate the exact spot. It probably belongs to the old collection of Pompeii.

The second Pompeiian boiler (No. 78,673), illustrated by Fig. 4, and shown in vertical and horizontal sections by Figs. 5 and 6, is much more simple than the boiler above described, not only in the internal construction, but also in the decoration.

This boiler has the form of an urn or an ancient vase, and is constructed of bronze, cast in one piece. On the outside it measures nearly thirty centimeters in diameter in the widest part, and forty-four centimeters in height. Inside is the oven or furnace, B, consisting of a cylindrical shell attached to the outer shell of the mouth, C, from whence it turns inward and downward, widening in the meantime until it reaches the grate, just below which it flanges outward, and is attached to the outer shell. Thus we have an inner and outer cylinder, the annular space between forming a water jacket, in which was contained the liquid to be heated. The surface of the inner cylinder constituted the heating surface of the boiler. The boiler is also provided with water grates, consisting of tubes made from sheet bronze, and opening at both ends into the annular water space or jacket. Here, then, is another ancient example of the water tube principle, this apparatus being constructed with a view to attaining greater efficiency by the more extensive heating surface and more active circulation.

To the sides of this urn-shaped boiler are attached two very simple handles, and the whole is supported by an elegant tripod of a little more than ten centimeters in height.

It has been suggested that this apparatus may have

FIG. 1.—ANCIENT POMPEIIAN BOILER.

Fig. 2.

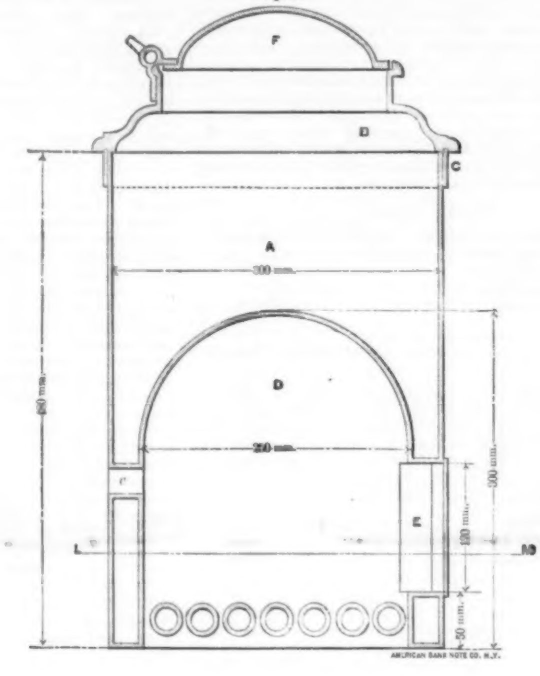
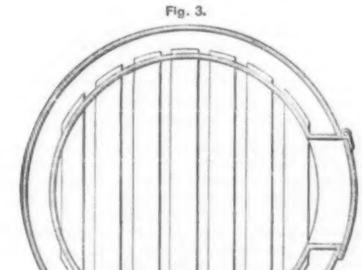


Fig. 3.



SECTION THROUGH L M

VERTICAL AND HORIZONTAL SECTIONS THROUGH BOILER SHOWN IN FIG. 1, SHOWING WATER TUBES.

* Presented at the New York meeting (December, 1896) of the American Society of Mechanical Engineers.

served at some time to heat wine as well as water, which suggestion appears reasonable, as many competent authorities agree that the Pompeiians made great use of hot drinks. Probably this urn, or boiler, was found in one of the "termpodi," or, in modern language, cafés, in Pompeii or some other city of the Campagne.

At Pompeii were to be found several of these merchants or dispensers of hot drinks, but my informant states that he has not ascertained to what other city of the Campagne it may have appertained; that is to say, he is not positive that this apparatus was really found in Pompeii, though he is fully satisfied as to the origin of the first apparatus described above.

It should be noted also that the opening through which the fuel entered was judiciously placed on the same side as the hinge for turning the lid, thus enabling the attendant to incline the urn for the purpose of pouring out part of the liquid contents without spilling the fuel.

This urn-shaped boiler does not, of course, present so striking a resemblance to some of our modern boilers as the first boiler described above, although it appears to be the boiler which has been illustrated and described by quite a number of trade journals and technical papers during the past two years.

I have also received from the Dutch consul at Genoa photographs of a group of ancient Pompeiian relics obtained through a friend of his in Naples. The photographs reproduced here in Figs. 8 and 9. Evidently the subject offered this layman little in the way of either romance or sentiment; consequently, our record is deficient in that it lacks any accurate description of the articles illustrated in the photographs. It is assumed that the apparatus shown in Fig. 9 is the boiler referred to in the different descriptive articles which

FIG. 4.—ANCIENT POMPEIIAN BOILER.

Fig. 5.

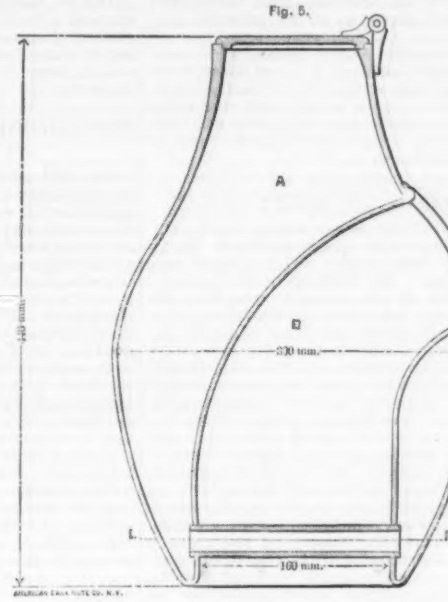


Fig. 6.

SECTION THROUGH L M

SECTIONS THROUGH BOILER SHOWN IN FIG. 4.

ANCIENT BOILER AND KITCHEN COOKING UTENSILS.

have appeared in the technical papers lately. The central group, Fig. 8, is said to represent merely ordinary kitchen furniture, used no doubt in the culinary department of some large household. Certain features of this group brought out by the photograph might indicate that this apparatus was utilized for more important work, and it is unfortunate that we cannot have some further information as to its internal construction.

The description of the two boilers is somewhat meager and unreliable, but sufficient is given to establish the fact that the large boiler (Fig. 9), at least, is provided with a water jacket, with some form of grating for supporting the fire underneath. A cock at one side, which appears to be very artistically decorated, served to draw off the heated liquid.

EXCAVATING IN EGYPT.

THE opening lecture of the season was given by Dr. W. M. Flinders Petrie to the members of the Philosophical Institution, Edinburgh. The subject was "Excavating in Egypt: its Methods and Results." The general character of the country was first described by the lecturer, with views of the plateau of limestone rocks through which the Nile valley is cut to a depth of 1,500 feet, channeled along the sides with grand gorges cut by the ancient rainfall. In Middle Egypt that desert region was lower and more or less sandy, with rocks cropping out in many parts. Though the rainfall had now ceased in Egypt, yet the Nile filled its ancient bed for a part of every year, fed by its Central African sources, and the water extended across the whole valley many miles in width, during which time no agricultural work could be carried on by the people. Along the banks of the canals, where the water supply was continuous all the year, the richness of the vegetation and the beauty of the scenery was most delightful, contrasting with the noble spaciousness and freedom of the great rocky desert on either hand. The excavations were sometimes in towns, or else in temples or in cemeteries. The carved limestone lintel of the Temple of Nubt, found last year, was shown by the lecturer as a fine instance of the delicate carving of hieroglyphs and symbolic scenes. A great source of historical information, he continued, was in the deposits which were placed in the foundations. These were models of the vases used in the ceremonies, of the tools employed, of the building materials, and of the food and utensils required by the workmen. The date was shown by blocks of stone or of metals bearing the king's name. Another class of technical remains was the series of drawings and trial sculptures from the schools, which practiced inside deserted temples where fine work could be found for copying. The common material for writing and drawing on was potsherd, and the spirited and able sketches on that rough material were often admirable—such as a peasant lad going out into the world, and heads of kings and of a girl. The last mentioned had been ridiculed by another student, who had added a dog scratching the girl's nose. In another technical line they had the set of iron tools discovered at Thebes with an Assyrian helmet, belonging to probably 670 B. C., and showing the high state of tool manufacture in Assyria at that date, at which most of the modern tools appeared already in use—the saw, chisel, rasp, file, twist scoop and center bit. Of the great historical discoveries of recent years, one of the most importance was the tablet with the mention of the war of Merenptah with the Libyans, and his subduing the people of Israel in Palestine. That was a vast block of gray syenite, over 10 feet high and 5 feet wide. It was first cut and engraved by Amenhotep III for his temple at Thebes about 1420 B. C., and was taken from there by Merenptah to build it into his own temple, and inscribe the back of it with the account of his wars about 1200 B. C. It bore the only mention of the Israelites yet known on Egyptian monuments, and was earlier by four centuries than any such record from Assyria. Beside that tablet a splendid half length figure of King Merenptah was also found, which showed far the best portrait yet known of the king who was believed to be the Pharaoh of the Exodus. That and the tablet were found last spring in the ruins of the temple of that king at Thebes. Near there was also a beautiful head of a queen carved in limestone. A little fragment, which showed the naturalistic work of earlier times, was also found this year—an ivory carving of a boy carrying a young calf on his back, which belongs to the twelfth dynasty, about 2500 B. C. From the curious artistic movement of naturalism which took place about 1380 B. C. under the influence of Akhenaten there were shown by Dr. Petrie some examples. The actual death mould of that king's own head was found on the spot where his funeral furniture was prepared. The dreamy, thoughtful and delicately marked character of the king were strikingly shown in that strangely preserved copy of his living self. The spirit and freedom shown in sketches of horses' heads, carved on limestone and drawn upon pottery, seemed like the work of a Greek or a Renaissance artist. In fresco work shading was used, as shown in a group of two little princesses seated together. The work of excavating was carried on by gangs of carefully selected workers; each was observed and his character considered, and he was educated to straightforwardness and skill, so that after a month or two of training the best lads were just like the hands of the master; they could do whatever they were told to do, and could be well trusted. Such work was a most interesting study of character and ability. The complete confidence which could be established with the better class of Egyptian peasant was the most pleasing part of his nature. In place of trying to always elude authority, as he had been accustomed to do all his life, he would trust his master absolutely, make him his banker and implicitly do what he was told. The best age was from twelve to eighteen, when their wits were at the brightest. In the Delta the girls also worked and did quite as well as the boys. The amount done without any pressure, entirely by piecework, was amazing. Two boys of twelve or fourteen would cut and remove 24 cubic yards a day, as much as three English navvies and be ready for an hour's ball play at the end of it; and all the work was done on coarse bread, with an occasional onion or egg. The system of payment was always by the piece, at about 1½d. a cubic yard with extra money for the full local value of every antiquity that they found, so that there was no temptation to keep back anything that was found. The Egyptian had great capacities for work, and when dealt with fairly there were plenty of honest and reasonable men to be found. But he was incapable at present of trusting his own kin or of any united action, and was never so happy as when led by any one whom he trusted. There seemed no reason for trying to upset such a character with new ideas, but rather for insuring that he had a safe life and good leading. There was a large audience.—The Architect and Contract Reporter.

PSYCHOLOGICAL NOTES UPON SLEIGHT OF HAND EXPERTS.*

THE determination of the influence of special kinds of occupation and training upon the delicacy, range and quickness of sensory, motor and mental powers is an important and interesting problem. Observations of this kind must first be directed to the determination of the average capabilities of average individuals and then be extended by a study of the influences of age, sex, heredity, training and a multitude of other factors upon the growth and perfection of special powers. Last of all will come the study of small special groups of persons and of the individual himself. At all times, however, an individual with exceptional powers in any direction is quite certain to attract attention and arouse interest; psychological tests made upon such virtuosi are desirable, even if in individual cases they suggest no very decided conclusions.

Having recently enjoyed visits at my psychological laboratory from Messrs. Hermann and Kellar, the widely known prestidigitators, I put together the results of the series of tests to which they kindly submitted. As the time at my disposal for these tests was limited, I selected such as might be supposed to be related to the processes upon which their dexterity depends, and such as seemed most likely to yield definite results.

Beginning with tests of tactile sensibility, I determined the distance at which two points of an aesthesiometer placed upon the forefinger of the right hand could be recognized as two. This distance was for Mr. Hermann 3·5 mm. and for Kellar 2·5 mm. A comparable average result, obtained from a considerable number of miscellaneous individuals, was about 2 mm., indicating a somewhat coarse sensibility for the two special subjects. The attempt to arrange in their correct order a series of five weights increasing by $\frac{1}{12}$ of their weight was unsuccessful in the case of Mr. Hermann, but was successfully carried out by Mr. Kellar. The attempt to arrange weights differing by $\frac{1}{10}$ was entirely unsuccessful for both of them. In a general series of tests, 92 per cent. of those tested arranged the former series correctly and 66 per cent. the latter. The weights were estimated by lifting them between thumb and forefinger. A test of sensitiveness to textures was also made. The fingers were passed across a surface composed of wires wound closely side by side. Mr. Kellar was tested with a series in which each surface was ¼ coarser than its neighbor, and with one in which the differences were only ⅙. He arranged the first correctly, but was entirely mistaken in the arrangement of the second. Mr. Hermann tried only the finger differences, which he also failed to arrange properly. I next tested the same sensibility by having the subject feel between the thumb and forefinger, as in feeling the thickness of paper, a set of single wires of various calibers, mounted upright on wooden blocks. In one series the differences were $\frac{1}{4}$, in another $\frac{1}{8}$. Both Mr. Hermann and Mr. Kellar succeeded in arranging both series correctly, but this was also done by nine out of ten persons who were tested in the same way. Still another form of tactile and motor capacity was tested by requiring the subject to arrange in order a series of bars of varying length by passing the forefinger across them. Both Mr. Hermann and Mr. Kellar passed this test successfully in the series, varying by $\frac{1}{15}$ of their average length; but when the series varied by only $\frac{1}{18}$ Mr. Kellar made one slight mistake and Mr. Hermann's arrangement was correct. The former task was successfully accomplished by 60 per cent. and the latter by 50 per cent. of a large group of persons similarly tested.

As both Mr. Hermann and Mr. Kellar have made themselves by persistent training quite ambidextrous, being able to perform sleight-of-hand tricks with either hand (although both are naturally right-handed), it is interesting to record the results of the attempt to move the two hands equally far from a common starting point. For Mr. Hermann, in single excursions, the right hand moved 318, 330, 123, 302, 116, 260 mm.; while the left hand moved 316, 344, 140, 268, 160, 225 mm. The average right hand movement was 241·5 mm.; the average left hand movement, 247 mm. In three cases the left-hand movement was distinctly longer, in one case the right hand was distinctly longer, and in two cases they were nearly alike. The two hands did not move very well together, but there seems to be no constant error in one direction. The average excess of the left hand is 5·5 mm., while the general average for those who have the same tendency is 13·75 mm. It may be added that, in general, about an equal number of persons would have the tendency of moving the left farther than the right as would have the tendency of moving the right hand farther than the left. A similar record for Mr. Kellar was right hand 281, 357, 404, 155, 108, 313 mm.; left hand 268, 333, 411, 187, 133, 337 mm. This makes an average excess for the left hand of 8·5 mm., the average right hand movement being 270 and left hand 278 mm. Differences of the two hands are nowhere large, the excess of the left hand appearing in four of the six movements. The next test consisted in marking off, by a movement of the arm (the eyes being closed) five equal distances, by raising a pencil from a strip of paper and bringing it down again. The average deviation of these movements from one another was for Mr. Hermann 16·1 per cent. of their average length, for Mr. Kellar 5 per cent. in his first trial and 12·6 per cent. in his second. The general average deviation for this test was 11·8 per cent.

A few tests of the accuracy of visual perception were made as follows: A line 100 mm. long was to be divided in half. For Mr. Hermann the left half measured 49·75 mm.; for Mr. Kellar in his first attempt 50·75 mm., in his second attempt 52·2 mm. The average error in this test is about 1·75 mm. The same line when divided into three equal parts resulted as follows: For Mr. Hermann, left 33, middle 34, right 33 mm. For Mr. Kellar, in the first attempt, left 35·5, middle 34·5, right 30 mm.; in the second attempt, left 33, middle 35·5, right 31·5 mm. The general average record for this test was, left 32·0, middle 34·5, right 32·7. The subjects were next required to mark off on the three arms of a cross a distance equal to that (50 mm.) marked off on the upper arm of the cross. The lengths of the arms were unequal and the cross asymmetrically placed on the paper. For Mr. Hermann the left arm was 70·5, right arm 44, lower arm 60·5 mm. This large error can only be accounted for by the confusion of the distance from the center outward with that from the margin of the paper inward, but the possibility of such a confusion is not indicative of an accurate observation. Mr. Kellar's result was, in the first attempt, left arm 54·5, right 52·5, lower 50 mm.; second attempt, left 55·5, right 54·5, lower 51 mm. The average results of a large group of individuals in this test were left 54, right 54, lower 61 mm. Mr. Kellar's error for the lower arm is thus less than the average one. Another test of visual perception is called the "form alphabet." It consists of twenty-five characters composed of short and long vertical and horizontal strokes in various combinations. 215 of these are printed upon a sheet in miscellaneous order. A certain one of these is singled out for identification and the subject is required to indicate as many occurrences of this character as he can detect within a limited time (90 seconds). In the first attempt Mr. Hermann did not fully comprehend what was wanted, marking off 10 right and 19 wrong ones. In the second test he marked off 8 correct ones. Mr. Kellar marked off 7 correct ones in the first attempt and 11 in the second. The general average of persons succeed in recognizing about 8 forms in this time.

Quite a number of tests of the quickness of movement and of mental processes were made. For Mr. Hermann the maximum number of movements of the forefinger alone was 72 in 10 seconds, or 7·2 per second, and of the forearm 75, or 7·5 per second. For Mr. Kellar, forefinger 83 in 15 seconds, or 5·5 per second, and for the forearm 127, or 8·2 per second. The average of a large number of individuals for the forefinger movement was 5·4 per second, and of a group of ten persons, tested more nearly in the same way as were Messrs. Hermann and Kellar, 4·8 per second. The average forearm movement of the same ten persons was 7·5 per second. It thus appears that the movements for both Mr. Hermann and Mr. Kellar are rapid; Mr. Hermann's forefinger movement being exceptionally so, while Mr. Kellar's forearm movement is the better.

Passing to the ordinary forms of reaction experiments, Mr. Hermann's reaction to a touch upon the right hand was remarkably short, especially for one who had never been a subject for reaction experiments before. The average of six trials was 104 σ ($\sigma = \frac{1}{1000}$ second), with an average variation of 11 σ. Mr. Kellar's time was 129 σ, with an average variation of 10 σ. For sound reaction the time was: Hermann 163 σ, variation 32 σ; Kellar 116 σ, variation 25 σ. For visual reaction, Hermann 126 σ, with variation of 26 σ, or omitting one irregular result, 111 σ, with variation of 8 σ; Kellar 125 σ, variation of only 6 σ. For a considerable group of average individuals, reacting for the first time, the following numbers have been found: For touch, 172 σ; sound, 165 σ; sight, 176 σ. It thus appears that both of the special subjects tested react far more quickly than the average individual. Another form of reaction involving manual quickness of movement was arranged as follows: Two keys were placed three feet apart, and the time measured that elapsed between the touching of one and a movement over to and touching the other. Mr. Hermann's time for this reaction was 610 σ, with a variation of 76 σ; Mr. Kellar's time was 299 σ, with a variation of 23 σ. The average of ten individuals making the same test was 364 σ, with an average variation of 32 σ; but these ten individuals show considerable variation among one another. Mr. Kellar's time is thus somewhat below the normal, although it is equaled by six of the ten persons tested, while Mr. Hermann's time is unaccountably long. As a type of reaction involving a choice, the distinction of red and blue, associated with movements of the right and left hands, was selected. In this Mr. Hermann's time was 301 σ, with a variation of 64 σ; Mr. Kellar's time, 256 σ, with a variation of 56 σ. For a simpler choice I have an average record of 259 σ, and for the same reaction the average of ten individuals is 297 σ, with an average variation of 44 σ.

A more complicated reaction involved a movement with any one of the five fingers in response to the appearance of the numbers 1, 2, 3, 4 or 5 behind the opening in a screen. Mr. Hermann's time for such a reaction was 901 σ, with a variation of 200 σ; Mr. Kellar's time being 753 σ, with a variation of 91 σ. The average time of ten individuals for such a reaction is 588 σ, with a variation of 84 σ. It is thus quite clear that, while the simple reaction time for the two special subjects is much shorter than the normal, their time is just about normal in a reaction involving a simple distinction and choice, and is considerably longer than the normal in a reaction involving a complex distinction and choice.

The incident related of Houdin, the "king of the conjurers," regarding his remarkable powers of taking in at a glance the miscellaneous contents of a shop window, suggests another power of great use to the prestidigitator. Mr. Hermann claims to possess a similar power, although he does nothing in his stage performances that demands such a comprehensiveness of perception. I exposed for one-half a second ten patches of color requiring him to name as many as he could see; in each of two trials he named five correctly. When the color patches were different in shape as well as in color he was able to see three in one-half a second and describe them correctly. He was also able to read two words in the same time. I also counted the number of consecutive exposures of one-half second each needed for the reading of a sentence containing seventeen words; it required ten exposures or 1·7 words per exposure. In one-second exposures Mr. Hermann could read three isolated words, and required eight exposures to read a sentence of twenty-nine words or 3·6 words for each exposure.

Similar averages for a group of about forty persons indicate about the same quickness of perception for

* From Science.

color 4·5 as compared with 5; an inferior perception for combined color and form 1·8 as compared with 3, only 12 per cent. of those tested recognizing as many as three color forms; and likewise for words seen separately 1·4 as compared with 2 (22 per cent. reading two words), but a distinctly higher average of the number of words read in one exposure. On the whole, these few experiments would indicate that, as regards the quickness and scope of perception, Mr. Hermann would rank well (except in reading words in a sentence), but by no means exceptionally well in the general average.

For Mr. Kellar the tests were somewhat differently arranged. The patches of color and the various forms were arranged consecutively, and were read in order as one would read words on a line. In exposures of one second Mr. Kellar could read correctly four colors and three forms. In reading words scattered over the page he read two correctly in his first trial and three in second trial. In four successive exposures of one second each he read a sentence containing twenty-seven words, or an average of 6·75 words per second. Mr. Kellar would thus rank below Hermann in all but the reading of words in a sentence, in which he far exceeds him, but would be equaled by about 86 per cent. of a group of college students.

Another form of testing this capacity was attempted, but with no success. Mr. Hermann was shown ten pictures, and asked to study them for about forty-five seconds; he was then shown a card containing forty pictures and requested to mark off which of the forty were also seen on the former card. He marked off seven, four of which were correct and three wrong. For Mr. Kellar this test was more systematically made. He was shown a card containing forty pictures and at the same time a slip containing ten words, the names of a certain ten of the pictures, and asked to find the pictures named by the words as rapidly as possible. This took him just forty-five seconds, the average of a miscellaneous group of individuals being sixty-four seconds. A few minutes later he was asked to note on a card containing sixty pictures as many as he could remember having seen on the former card containing forty pictures. He succeeded in recognizing but 11, the average in this test being 17·5 pictures. I also tested Mr. Kellar's visual memory by having him look at a series of words for about five seconds, and then repeat as many as he could in correct order. He succeeded in repeating correctly five out of a series of six words, and six out of nine words. For a similar series of numbers his memory was much better. He could repeat seven numerals correctly, and in attempting to repeat a set of ten made but two errors. This is better than the average, but not remarkably so. It should be added that several very striking performances are given by Mr. Kellar in which memory forms a considerable part. It is, however, a very special form of memory, involving the formation of accurate associations and classifications rather than an extended series of impressions.

If we now select those tests in which the records of Mr. Hermann and Mr. Kellar differ markedly from the normal, we find as follows: In the quickness of response to a touch and visual stimulus both the special subjects, and Mr Kellar as well in response to an auditory stimulus, excel to a considerable extent the average individual. But this quickness of reaction does not appear in the more complicated reactions, and in the most complicated reaction they both fall considerably below the normal. In the quickness of movement we find decided indications of an unusual quickness for both Mr. Hermann and Mr. Kellar. In the scope and accuracy of visual perception we find in part a good record, but on the whole no very decided excellence appears. In tests involving mainly tactual perception and muscular perception, the indication is rather that they are below than above the normal. I might also add that I have repeated a few of these tests upon a local sleight-of-hand performer, and find for him a good record and particularly a great quickness of movement. This is perhaps to be explained by his facility in musical execution as a pianist and organist as well as in sleight-of-hand performance.

The positive results of the investigation are thus small, but as far as they go they are consistent with the forms of dexterity that are utilized in sleight-of-hand performances. They also indicate that it may well be that special skill in one very specialized form of training may be only slightly influential upon other forms of capacity. So little is known of the correlation of powers of this kind, and small series of tests are so apt to be affected by accidental errors, that any suggestions which the data seem to warrant must be put forward with great caution. The individual is interesting, but the methods of research are, and must be, particularly adapted to statistical groups.*

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THE BUREAU OF ETHNOLOGY AT WASHINGTON, U. S. A.†

THE Bureau of Ethnology at Washington has, during the last sixteen years, been carrying quietly on a work of the importance of which, we feel sure, that a number of students of anthropology have no knowledge whatever; we are equally sure that work itself, as well as those who labor in it, has not received due recognition. It is now nearly thirty years since the exploration of the Colorado River of the West was begun by the Act of Congress in America, and it is nearly twenty years since the various geographical and geological surveys which sprang up in connection therewith were dissolved, and since the foundation of the United States Geological Survey became an established fact. In the course of the work carried on by the survey its various members made most exhaustive anthropologic researches among the North American Indians, and the myriads of facts which these self-sacrificing workers collected were fortunately rescued for the benefit of all students, and for all time, by the beneficent help of the Smithsonian Institution, which had secured provision for the publication of a series of monographs on almost every subject connected with the manners and customs, history, religion, and languages, etc., of the various Indian tribes with which they came in contact. Under the authority of the Act of Congress, the Secretary of the Smithsonian Institution intrusted the management of this great work to the former director of the Rocky Mountain Region Survey, Mr. J. W. Powell, and thus the Bureau of Ethnology was practically established. It is a pleasant thing to be able to record that Congress supported the work both with patronage and with pecuniary assistance, and all will confess that the contributors to the success of the bureau have worked with a will so as to employ in the best possible manner, and to the best possible end, the funds which have been placed at their disposal. We have before us thirteen handsome volumes of reports, each containing several hundred pages of closely printed matter, and profusely illustrated with well executed colored plates, and many hundreds of woodcuts. No reviewer of these volumes could attempt to give an adequate account of them unless he had some scores of pages at his disposal, and it goes without saying that all that any writer can do here is to call attention to the plan of Mr. J. W. Powell's volumes and to the general contents, hoping that the reader will devote some portion of his leisure to the perusal of a set of works which are at once of the greatest interest to those who study man and his ways and of the first importance to the student of ethnography.

In setting out on his work, Mr. J. W. Powell says that throughout "prime attention has been given to language," for "with little exception all sound anthropologic investigation in the lower states of culture exhibited by tribes of men, as distinguished from nations, must have a firm foundation in language. Customs, laws, governments, institutions, mythologies, religions, and even arts cannot be properly understood without a fundamental knowledge of the languages which express the ideas and thoughts embodied therein." As a result of this opinion, the officials of the Bureau of Ethnology have devoted themselves to collecting materials for dictionaries of the North American languages, and for chrestomathies, and in time they hope to put grammars of the same before the world. With a view of enabling the philological student to determine what help he may or may not be able to obtain from these languages, the authors of the volumes before us give, every here and there, selected texts accompanied by interlinear transliterations, much in the same way as the early Egyptologists used to do in publishing hieroglyphic texts; and there is no doubt that this is a most useful plan. That it enables the careful reader at times to trip up his editor is true; but it is an honest method, and will be much appreciated by all painstaking students, for comparisons of words can thus easily be effected. Turning, though only for a moment, from language and from the characters which express language, that is to say writing, we see at a glance that the peoples of North America had many things in common with the most ancient civilized nations of antiquity.

We do not for a moment believe that every custom and belief which may be found among them should be used to connect them with the ancient Chinese, or Indians, or Babylonians, or Egyptians; but it seems perfectly clear that every primitive nation, wherever it may live on the globe, or whatever may be the circumstances under which it lives, has certain fundamental ideas about the future life, and religion, and morality, which closely resemble those of other early nations. It seems tolerably clear, too, that many anthropologists have erred somewhat in tracing connections between peoples of totally different races, which they have deduced from observing that they had many beliefs in common. A careful examination of the characters employed by early nations to express their ideas makes this quite plain, for as pictures were used by them all for this purpose, we have only to trace the conventional sign back to its oldest form to find out what fundamental ideas existed in their minds. Primitive man, wherever he existed, used as writing materials such natural objects as were readily obtainable. Strips of bark, dressed skins, pieces of wood, bones, flat pieces of slate or stone, rocks, clay, etc.; when he was sufficiently advanced to beat out or to cast plates of metal, iron and bronze were also used by him for this purpose. At a later period he found out the way to make papyrus and paper, and this once done the task of the writer was comparatively simple. His pen varied with the substance which he wrote upon: wood, stone and metal demanded a hard, sharp instrument, and skin and paper demanded only an object which would transmit the writing fluid to their surface in regular quantities at the will of the writer. Ink was in its earliest form simply a mixture of water with some burnt vegetable substance or mineral earth. The style and character of the writing were modified by the materials used; and this is only a natural result when we consider how easy it is to draw circles, curved lines, and intricate devices upon a smooth substance like dressed skin or paper, and how hard it becomes to cut the same in stone.

From the Chinese and cuneiform characters we may learn how, little by little, the original picture forms disappeared before the general use of stone and clay, and we know that the style of writing which was used for state documents was very different from that employed in the ordinary business of life. In the clay tablets of the last Assyrian empire, about B. C. 700, the cuneiform characters bear no resemblance whatever to those which are found on the monuments of the period of Entenna, about B. C. 4500; in the Demotic writing of Egypt, so far back as the period of the Ptolemies, the pictorial character of the ancient hieroglyphics (from which it was derived, through the intermediate form of the hieratic or cursive form of writing employed by the priests) has quite disappeared.

When we come to consider the characters used for writing purposes among the North American Indians, so ably discussed by Mr. Garrick Mallery (see "Sign Language among North American Indians," in the First Annual Report of the Bureau of Ethnology, p. 263 ff.), we find many pictures which show that they have much in common with picture signs in other languages. The sun is represented by a circle, as in Egyptian and Babylonian; sometimes it has rays shooting out all around it, just as we may see it in one of the vignettes of the ninety-second chapter of the "Book of the Dead." Sunrise is symbolized by a part of the disk showing above the ground; in Egyptian the disk is seen rising between two mountains. The star is represented by a small circle with four rays shooting from it, each toward a cardinal point; in Egyptian the star often has five points, but one of them probably represents the rope or chain by which the Egyptians thought it was hung out in the sky, and in Babylonian a star usually has eight points. The moon is represented by a crescent, as in Egyptian, Chinese, and Babylonian; heaven is a vaulted space, but in Egyptian it is drawn like the flat roof of a house, and has, moreover, supports by which it stands firm on the earth. To represent clouds a number of dark conical masses are drawn within the vault of heaven; the common Egyptian determinative for words meaning cloud is a stress of hair, and it is probable that this idea is common to both Egyptians and Indians. Similarly among both peoples rain was represented by lines of water falling from the sky. In fact, it would seem that natural objects, both animate and inanimate, were written always in the same way, whether the writers were Chinese, or Egyptian, or Babylonian, or people of Western Asia, or the makers of the Cretan pictographs which Mr. A. J. Evans has discovered, or North American Indians. Abstract ideas were probably expressed quite differently by all nations; but even to touch on this far reaching subject would be beyond the scope of this short notice. It must, however, be mentioned in passing that Mr. Garrick Mallery has collected a series of most important facts in connection with this subject in his "Pictographs of the North American Indians" (see Fourth Annual Report of the Bureau of Ethnology), a work which should be consulted by all who study the history of the development of writing in the world, and that he has further supplemented our knowledge of the subject by his later work, "Picture Writing of the American Indians" (see Tenth Annual Report of the Bureau of Ethnology). It is a curious fact that the peoples of North America did not invent an alphabet, as many of the other nations of the world have done, for it is clear to every one that a system of picture writing, however simple, is really a cumbrous affair, and the misreading of a picture sign might be at times accompanied by dire consequences. At a very early period Chinese, Babylonians, and Egyptians introduced an alphabetic principle into their writing, and the Persians succeeded in abolishing entirely the picture element from their system. The other volumes of reports are, each in its way, as interesting as those to which we have called attention, and from them we may learn that light and information can come from the West as well as from the East. The carefully made collections of ethnological facts, which we find in the series of works issued under the able direction of Mr. Powell, should do much to help and encourage other workers in their inquiries, and the scholarly way in which they have been set forth by his fellow workers reflects the greatest credit upon the Smithsonian Institution, and upon all who have been connected with their publication.

THE CASSEL-HINMAN BROMINE PROCESS OF GOLD EXTRACTION.

THIS process is intended for the extraction of low grade ores, not suitable for amalgamation, as, for example, the telluride ores of Colorado. The modus operandi is practically the same as in the chlorination process. The ore is crushed, dried, sifted, roasted if necessary, and treated, either by percolation in vats, or, preferably, is agitated in revolving barrels, with an aqueous solution of bromine (strength, apparently about 1½ per cent.) The liquid is then drawn off, the ore washed, etc. The chief and essential feature of the process is the subsequent recovery of the bromine, which is effected by adding bleaching powder, or potassium permanganate and sulphuric acid, to the liquor. The latter is then heated in a covered stone tank by direct steam. The bromine vapor is condensed in an earthenware worm, and there brought into contact with weak wash liquor from previous operations, for the purpose of regenerating bromine solution for future use. From a bath containing 15 lb. of bromine per 100 gal., the whole of the halogen is expelled, when 5 per cent. of the liquid has been distilled.

Important advantages are claimed for the process. As a solvent for gold, bromine is not only more rapid and thorough in its action than chlorine, but, on account of its superior solubility in water, may be used in stronger solutions (up to 3 per cent.) Unlike chlorine, however, bromine attacks only to a slight extent the useless constituents (pyrites, etc.) of the ore, and the proportion converted into bromide little exceeds that corresponding to the gold dissolved. On this account the preliminary roasting of the ore (to destroy sulphides, etc.) need not be carried so far as is essential in the chlorination process; and this is a point of great importance, since certain ores—particularly tellurides of gold—lose a large proportion of the precious metal, either mechanically or by volatilization, during the final stages of the roasting.—Abstract from the J. Amer. Chem. Soc. by the Journal of the Society of Chemical Industry.

The preservation of lemons, oranges and citrons destined for export from Italy, and not for immediate consumption in their integrity, but which are, nevertheless, valuable articles of export on account of the various uses to which their juices may be applied, is a very important object in those cases where the shipment and conveyance to distant parts would be impossible, either on account of the distance to be traversed or on account of the unsoundness of the fruit, or from both causes combined. It is customary in Italy to slice and steep the fruit in large casks filled with salt and brine. The bitter oranges, lemons or citrons are first of all examined, then soaked in salt water for a few days, the time varying between three and eight days, according to the more or less maturity of the fruit. On the arrival of the fruit, it is repeatedly washed in fresh water until the salt contained has been completely dissolved and carried off. It is, however, unquestionable that whatever the preserving qualities of the salt, the process involves an almost total loss of the essential oil of the peel, and a deterioration of the juice, and should only be resorted to in extreme cases, when the fruit would not be otherwise profitably used at home or shipped abroad.

* I feel that it is necessary to add that Mr. Hermann perhaps did not do himself justice in some of the tests. He was always quick, confident and decided in his judgments, often performing a test in half the time taken by the average person. He was much interested in the tests, but seemed confident of his ability to do what was required, with little effort. It may well be that with a little more deliberation, and an opportunity of even a brief familiarity with the tests, better results could have been secured.

† The Annual Reports of the Bureau of Ethnology to the Secretary of the Smithsonian Institution, by J. W. Powell, Director. Thirteen Annual Reports. Washington: Government Printing Office, 1881-1896.—Nature.

BOTANICAL DESCRIPTION OF THE LONGLEAF PINE.*

THIS tree was first described by Miller in the year 1768, under the name of Pinus palustris. The younger Michaux substituted for it the more appropriate one of Pinus australis, under which name it was described by succeeding writers and generally known to botanists of recent date. To satisfy the law of priority, the name given by Michaux has recently been dropped and the old one reinstated in the catalogue of North American forest trees,† published in the ninth volume of the census reports of 1880.

The most conspicuous and distinguishing feature of this species is the silvery thick terminal bud, or rather the budlike clusters of the young leaves inclosed in their finely fringed subtending scales. Its branches are rough, covered with the bases of the imbricated leaf scales, the elongated silvery fringes having fallen off.

ROOT, STEM AND BRANCH SYSTEM.

The longleaf pine attains a height averaging 100 feet, rarely exceeding 110 feet, with a diameter breast high, when fully grown, varying between 20 and 36 inches, rarely more. The tall, straight, very gradually tapering trunk arises from a massive taproot which, in favorable situations, penetrates the soil to a depth of from 12 to 15 feet, and sometimes much more. It has several stout, comparatively short lateral roots, which assist the tree in its hold by slanting deeply into the ground, and some of greater length are placed more or less near the surface. Its crown is open and elongated, of irregular shape, about one-half to one-third of its height. The stout limbs are rarely over 20 feet in length, twisted and gnarled and sparingly branched. The trunk is covered with a reddish brown bark, one-fourth to three-fourths of an inch thick, furrowed throughout its full length, crossed horizontally by deep fissures, and scaling off in thin, bluish, almost transparent rhombic flakes.

LEAVES AND THEIR MODIFICATIONS.

Like all the pines, this species produces during various stages of its growth seven different modifications of leaves as recognized by botanists, all more or less specific in character:

(1) Cotyledonary, or seed leaves (first leaves of the embyro), which soon wither and disappear. (2) Primary leaves succeeding the former immediately on the main axis, which either wither or later on are transformed into, or succeeded by, more or less permanent bracts or scales covering the branches (Fig. 1, a). (3) The secondary or foliage leaves rising from the buds produced in the axils of the primary leaves or of the bud scales by which they are represented, permanent foliage of the tree, with three leaves in one sheath. (4) The bud scales forming the sheaths of the foliage leaves at base. (5) Involucral bracts of the male flower (Fig. 1, f). (6) Involucral scales of the female inflorescence (ament) (Fig. 1, e). (7) The bracts which support the carpellary scale bearing the seed (Fig. 1, h).*

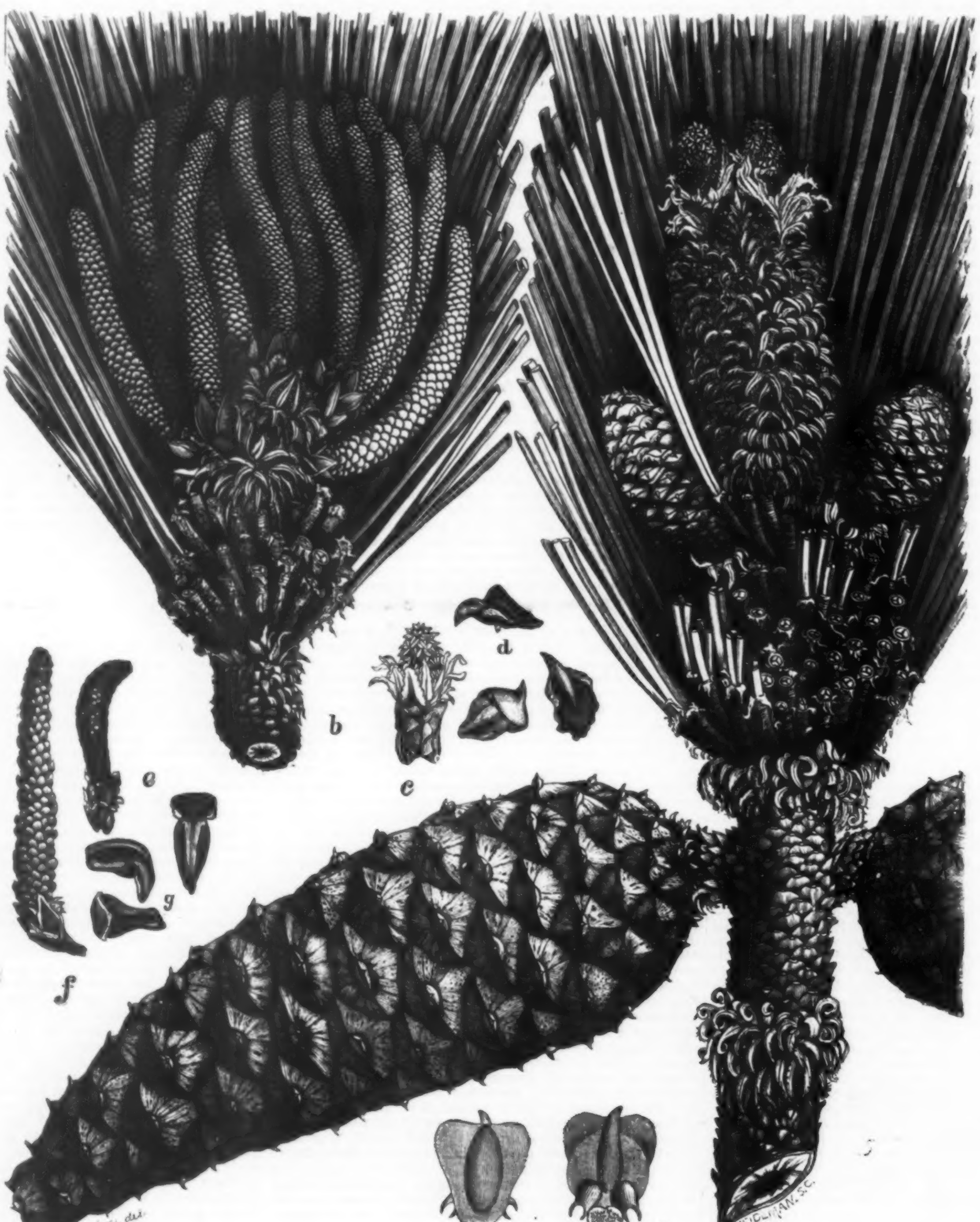

FIG. 1.—PINUS PALUSTRIS—MALE AND FEMALE FLOWERS.

FLORAL ORGANS.

The male and female flowers are sometimes found on the same branch; they are, however, more frequently situated on different branches, the male flowers mostly on the lower (Fig. 1, b). The male flowers consist of a slender axis, the staminodial column, around which the numerous naked anthers are densely crowded, forming a cylindrical catkinlike flower from 2 to 2½ inches and over in length, surrounded at the base by a calyxlike involucre consisting of twelve ovate somewhat leathery bracts, of which the lowest pair or exterior ones are laterally compressed, strongly keeled, and much smaller. The connective of the dark-rose purple anthers spreads out in a semiorbicular denticulate crest; a number of these male flowers are crowded around the base of this year's shoot, forming a dense whorl. After the discharge of the pollen the withered flowers remain for several months on the tree. The pollen remaining for a long time suspended in the air is often wafted to widely distant localities. In the latitude of Mobile its discharge takes place during or shortly after the second week of March.

The female flowers (see Fig. 1, a) are united in a subterminial oval, erect, short-stalked catkin, which is also surrounded by an involucre, the brackets being more numerous, longer, more acuminate, and membranaceous than those of the male flower.

The carpellary scales bearing ovules are oblong oval, tipped with a strong reflexed point, and are almost hidden by the thin flat scales by which they are subtended, which, however, they soon surpass in size. During the first year the young cones make but slow progress in their growth. On the opening of the second season they are scarcely over an inch long; during the summer they increase rapidly and reach their full size during the latter part of the fall. The cones are placed horizontally on the branches below the terminal bud (subterminal), sessile, slender, conical with a slight curve and from 6 to 8 inches long; of a dull tan color; the thick scales are light to dark chestnut brown on the inside, 2 inches or slightly over in length, and bear on their exposed end, or apophysis, a small but prominent tubercle armed with a short recurved prickle (Fig. 2). Fig. 2 exhibits truly and fully the open cone and especially the fine markings on the apophysis of the scale. The cones are shed in the latter part of the winter of the second year, rarely remaining to the following spring. On breaking from the branches they leave the lowest rows of the scales behind.

SEEDS.

The seeds are strongly convex, oblong, oval, less than a half inch long, and surrounded by the long oblique wing (see Fig. 2). The shell is whitish, at the front face marked by three prominent ridges, flat, smooth, and darkly spotted on the posterior side. It incloses an oily kernel, covered by a white seed coat; rich in nutritious matter and palatable, the seeds furnish in fruitful years an abundance of mast. They are shed before the fall

* From "The Timber Pines of the Southern United States." By Charles Mohr, Ph.D. Bulletin No. 13, Division of Forestry, United States Department of Agriculture, Washington, 1896.

† "A Catalogue of North American Forest Trees, exclusive of Mexico," by C. S. Sargent.

* George Engelmann: "Revision of the Genus Pinus." Transactions of the St. Louis Academy of Science, 1882.

of the cone during the dry weather, most abundantly during the latter part of the fall (end of October or November the best time for their collection) and in a lesser degree during the winter. They germinate easily after reaching maturity, and it often happens, in wet, sultry weather that they begin to sprout before leaving the cone, in which event the whole crop is destroyed. This, together with the killing of the flowers by late frosts, seems to be one of the main causes of failure of the seed crop so frequently observed. From the behavior of the seed just mentioned and from its oleaginous character it is to be inferred that the period of time during which the seeds retain the power of germination under ordinary circumstances is but a short one; but, as a matter of fact, seeds a little over a year old have been known to germinate.

THE WOOD.*

The wood of the longleaf pine is heavier and stronger than that of any other pine offered in the market. The average weight of the kiln-dry wood is about 38 pounds, that of the lumber where the outer lighter portion of the log is largely cut away about 40 pounds, per cubic foot. The kiln-dry wood of the butt weighs about 45 pounds per cubic foot; that of a log 50 to 60 feet from the ground only about 33 pounds, a decrease of weight (and with it of strength) of about 25 per cent. Similarly the wood of inner portions of a log is 15 to 20 per cent. heavier than that of the outer portions; or, in other words, the wood laid on when the tree is young is heavier than that laid on when it is old, quite contrary to the common belief, which seems to associate the light sap wood color of the young sapling with inferior material. The wood shrinks about 10 per cent. of its volume in drying, about 6 to 7 per cent. along the rings (tangentially) and 3 to 4 per cent. along the radius; seasons easily and without great injury. As in other pines, the greatest amount of water is contained in the sap wood, varying from 30 to 50 per cent. of the weight of the fresh wood, while the heart wood contains but about 20 per cent.

In its stiffness and strength the wood is remarkable. The average of a great number of tests indicates for the dry wood of longleaf pine an elasticity of 1,540,000 pounds per square inch; strength in cross breaking, 10,900 pounds per square inch; strength in compression, 6,850 pounds per square inch; strength in tension, 15,200 pounds per square inch; strength in shearing, 706 pounds per square inch.

* This statement is furnished by Mr. Filibert Roth, in charge of timber investigations in the Division of Forestry.

EXPLANATION OF FIGS. 1 AND 2.

Fig. 1 a, branch with two female aments (second week of March), at the end of terminal young shoot of the season densely covered with fimbriate silvery bract subtending the leaf buds which are still hidden in their axils; below are two immature cones of one season's growth and mature closed cone of two seasons' growth (October); b, branch with the male inflorescence, the leaves cut away to show the dense cluster of male flowers which closely surround the apex of the young shoot; c, female ament with basal scales forming the calyx-like involucre; d, d, d, carpellary or seed bearing scales of female flowers more advanced, lateral, ventral, and dorsal views—magnified 5 diameters; e, detached male flower with basal involucral scales, before opening (dehiscence); f, male flower, after discharge of the pollen; g, three detached anthers, lower sides showing longitudinal slits of the pollen sacs just opening; lateral view of an effete anther; another seen from upper side showing the transverse semilunar crest—all magnified 5 diameters; h, detached female flower seen from above; the cuspidate carpellary, or seed scale, bears two strongly bifid naked ovules at its base; i, female flower viewed from below, dorsal side; the bract almost covers the carpellary scale, leaving only the tip of the latter and the cusps of the ovules visible; magnified 5 diameters.

Fig. 2 a, mature open cone, after shedding seed; b, cone scale seen from lower or dorsal side showing the apophysis with low umbo and small, weak prickle; c, cone scale seen from upper or ventral side with seed in place; d, seed, upper side; e, seed detached from c, lower side; f, seed detached from wing, upper side, and g, the same seen from lower side.

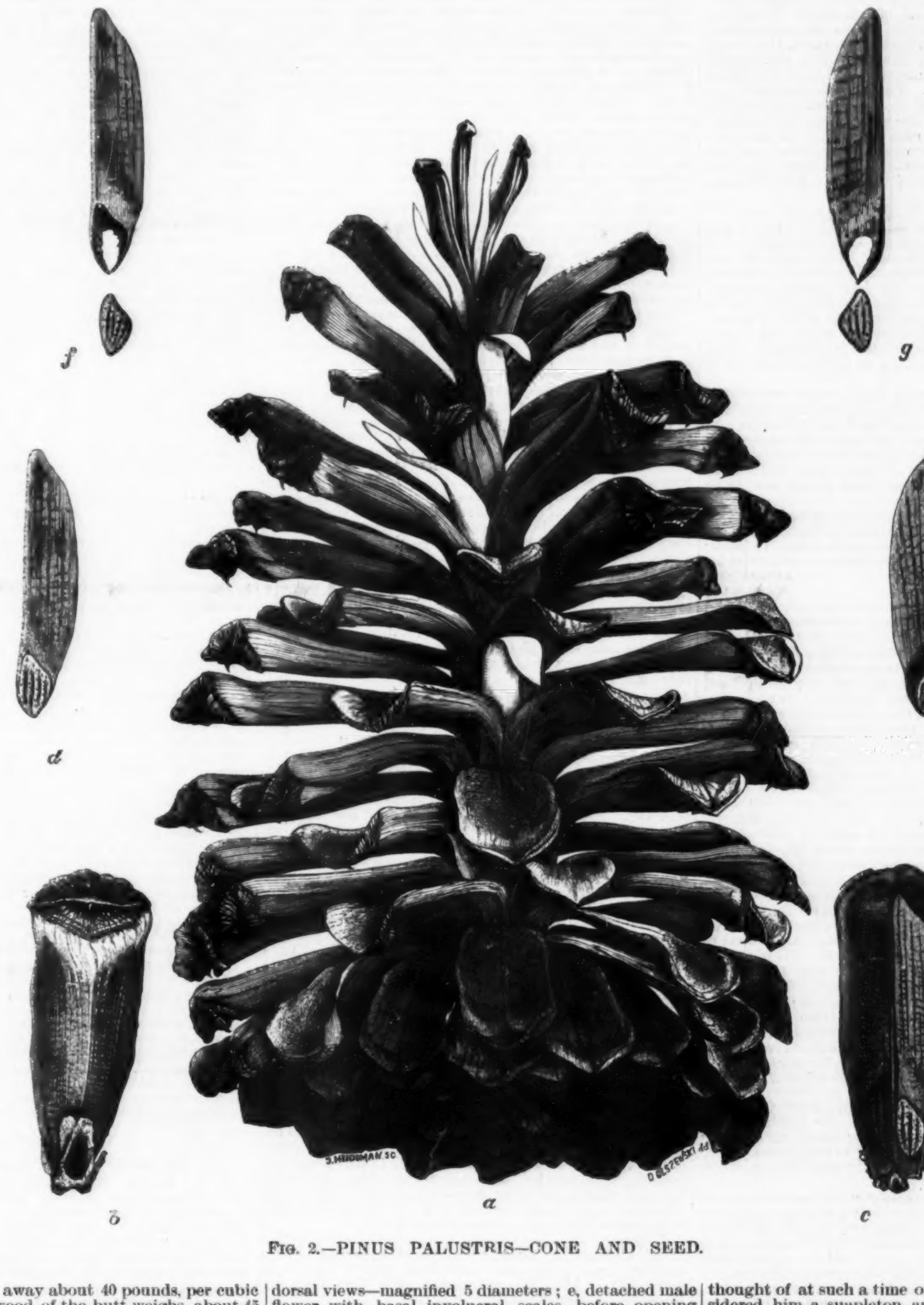

Fig. 2.—PINUS PALUSTRIS—CONE AND SEED.

HOW COCHINEAL IS CULTIVATED.

SOME FACTS ABOUT THE WAY IN WHICH THE INSECT IS PROPAGATED.

Although within moderate distance of our shores, the Canary Islands are but little known geographically or historically, and still less commercially. They have, however, some sort of a reputation as being the locality where folks live peaceful and tranquil days, where there is no snow, but little rain, no severe winters, but a never changing, balmy air breathed from the sea.

It may be so, but, commercially considered, the Canaries are of importance from the immense variety of their products—cereals, vegetables, fruits, flax, saffron, honey, wax, and lastly, but by no means least, cochineal; and it is of this latter we have just now more especially to write.

The introduction of the cactus and cochineal into the islands is interesting and worth relating, as it is not generally known. A native gentleman brought them from Honduras, in the year 1835, and at a time when the vines were flourishing, and no other crop was thought of at such a time of success. His friends considered him a simpleton, and the country people destroyed his plantations at night. The government, however, supported him, and in spite of occasional disturbances, the cochineal and cactus were preserved in out of the way places in the islands. As time passed on, the vine disease made its appearance and spread over the district. The fruits withered and plants died, and the inhabitants had only the alternative of starvation or some new path of industry.

They now turned their attention to the despised cochineal, and tried the experiment of cultivating it in the old vineyards. It succeeded perfectly. The insects propagated rapidly, and soon became a profitable crop. A great enthusiasm now followed the old contempt of cochineal. Spare land, fields and gardens were all turned to account in its cultivation, and in six months after setting out the leaves the harvest began, and for some time the industry flourished, fortunes were made, and the prosperity of the islands was assured. This cochineal is an important dyeing material, and is com-

posed of the dried bodies of the insect bearing the same name.

The Canaries consist of seven islands, the most important of which is Gran Canaria, one hundred and twenty miles in circumference. Las Palmas is the seat of government, and for other reasons is an important place, and being on the slopes of two mountains, in a delightful valley covered with palm trees and highly cultivated, extending to the sea, it is most attractive for visitors. The whole island is in a perfect state of culture—pasture lands on the heights, corn and cochineal in the valleys—so that altogether this island is the richest of the group. Arucas stands seven hundred feet above the level of the sea, built round the base of a crater; its great product and chief trade is cochineal, and the fields of opuntia, upon which the insects feeds and is reared, present a strange sight.

The name of the plant is the old Latin term used by Pliny, and said to be derived from the city of Opus. The cultivation of the plant is easy, as it grows freely in sunny spots; the only thing detrimental to its welfare is a superabundance of moisture, but this never happens in the Grand Canaries. The plants are called by the Spaniards Toona; but the insect does not confine itself entirely to the cacti, but feeds on other succulent plants, and the difference of quality in the article depends entirely on the plant on which the insects feed.

The prickly pear, so abundant in Jamaica, is covered with them, but not having their suitable and proper food, they are in general diminutive, and have very little red tincture in their bodies. The delicate red juice of the fruit is the natural food of the insect. Its exuviæ and animal salts are, from the minuteness of its body, inseparable from the essential properties of the dye, and tend to diminish somewhat the brilliancy of the color. On this account attempts have been made to obtain the inspissated juice of the plant directly from itself.

The cochineal insect is small, and was for long mistaken by Europeans for some kind of grain or seed, but it really belongs to the sub-order Hemiphera, and to give it its scientific name is Coccus cacti. The males are carmine red with light brown wings and the bristles are two and a half times longer than the body, which is three-fourths of a line long; while the female is one line in length, rounded in form and covered with a heavy bloom. Some idea may be obtained of its size when one pound of cochineal is calculated to contain 70,000 insects; in a dried state each one is estimated to weigh one-tenth of a grain.

The female is apterous, and is found in the proportion of one hundred and fifty to two hundred to one of the male sex. The former remains fixed on the cactus and lives there; her skin secretes a soft kind of envelope, in which she deposits her eggs, after which she dies, and nothing remains of her but a handsome membrane which protects the eggs. The male alone is able to move.

In Guatemala, in order to produce cochineal, it is necessary to prepare the land, and to plant rows of cacti at a distance of about two yards apart in lines; these are allowed to grow to a certain size, when the insects are placed on them. The eggs are then laid and hatched. They are very numerous, and only a small number of female insects are needed on each leaf. Before the rainy season commences, branches of the cactus plant covered with these insects are cut off and stored in buildings to protect them from the weather. When the wet season is over, the plantations are stocked from these supplies, little nests of some vegetable fiber, each containing a few females, are placed on the cacti. When the eggs are hatched, the young females are soon developed and spread over the plants, attaching themselves to the leaves, and present the appearance of being vegetable excrescences rather than living insects. They become covered with a cottony substance. The first crop of pregnant females, only these being valuable for cochineal, is gathered in December, and several more crops are obtained until the following May.

In the Canaries it is usual to rear in the winter, and put out on the cactus leaves from May to July. Small gauze bags containing the insects are hung on the cacti in the same way as in Guatemala. In August and September they are collected, and a walk in the streets of Arucas at this season will show the activity present on all sides. The insects are collected on large flat trays, and those gathered in one day are placed in the evening in an oven heated to 150° F. They are afterward exposed to the heat of the sun, and by hot irons and boiling water are made black. This is also done by placing the insects with some black sand in a linen bag several feet long, which two men swing backward and forward till the juice exudes, rendering the insects black, after which they are dried and again shaken with sand to give the cochineal brilliancy.

According to the way the insect is killed and dried, the product is known in commerce as silver or black, an inferior kind being sometimes called foxy. In the locality what is known as madres, or mothers, also called gray cochineal, from its being chiefly all coloring matter, is considered the purest. The full grown young insect is called silver, and is dried with stones, while the negra is the black.

The insects themselves scarcely yield ten per cent. of pure dye, although the amount is generally supposed to be greater. The most productive, and, therefore, of greater value, are those that are carefully cultivated in plantations of their favorite plant, but an inferior sort is very common in the woods, feeding on a thorny cactus. This is called wild cochineal, but even when introduced into the plantations it remains inferior, and is sold at a lower price. Wild cochineal yields one-third less coloring matter than the fine. The species called granilla or dust is supposed to be principally made up of the inferior kind.

The industry has suffered very much through the introduction of aniline dyes. To prove this, it need only be stated that the amount of cochineal exported from the Canaries in one year amounted to 6,310,000 pounds, valued at £842,921, and a few years later, after the introduction of anilines, it only reached 1,449,968 pounds, valued at £78,521, and at the time of my sojourn cochineal was selling in the islands at from seven pence to ten pence per pound, a price which did not pay for production. Formerly, one acre of ground planted with cactus yielded, under favorable conditions, from three hundred to five hundred pounds of cochineal, worth £75 to £100 in cash.

This is a sad condition, affecting the prosperity of the islands, as it is on record that the Canaries have, even from remotest times, been noted for the production of dyes. One dye has been produced here for a period and then given place to another. In olden times a scarlet dye was extracted from the dragon tree in the form of a gum or resinous exudation, which was called by the Arabs dragon's blood. This was most rare and extremely difficult to collect, as the trees producing it were of slow growth and never very plentiful.—Confectioners' Union.

GENERAL WORK AGAINST INSECTS WHICH DEFOLIATE SHADE TREES IN CITIES AND TOWNS.*

The question of proper work against the insects which affect shade trees in cities and towns naturally divides itself under two heads: (1) What can be efficiently and economically done by city governments? (2) If city or town administrators will not appropriate a small amount of money to carry on work of this kind, what can citizens who are interested in the question of shade trees do?

The planting of shade trees seems to be considered a legitimate function of the board of public works in every municipality. It is sometimes done by a specially appointed officer, under the control of the superintendent of streets and sewers; or it is sometimes placed in charge of a subcommittee of the board, or a special commission of outsiders is appointed to superintend the work. Admitting that the planting of shade trees is a public matter, their care should also be a public duty. Yet in not one of the larger or smaller cities of the Eastern United States, with which the writer is familiar, is any proper amount of work done by the public authorities against shade tree insects. New York is the only city in the country where a man of entomological knowledge is employed to direct operations against shade tree insects, either in the streets or the public parks. That New York's investment is a good one, no one who knows the work of Mr. E. B. Southwick can doubt. By this remark the writer does not wish to be understood as advocating the appointment of a paid entomologist under every city government, although where the parks are large in cities situated within the region of greatest shade tree insect activity, such a course would always be desirable. With an intelligent and industrious superintendent of parks, or a city forester, or whatever he may be termed, and the wise expenditure of a comparatively small amount of money each year, the shade trees of any city could be kept green throughout the summer. The amount of money to be expended in this direction would naturally vary with the number of trees to be attended to, as well as with the variety and the size of the trees and the geographical location of the city. Even in Brooklyn, however (and this seems to the casual observer to be the most unfortunate of all our Eastern cities from this standpoint), it is within bounds to estimate that the expenditure of \$3,000 to \$4,000 a year would result in green shade trees the summer through. This amount, moreover, will in all probability not need to be an annual appropriation. The first cost of a proper spraying apparatus will have to be added, but the apparatus once purchased and thorough work performed for two or three years, consecutively, the probabilities are strong that the number of shade tree insects will be reduced to such an extent that a much smaller annual expenditure will be sufficient.

The question of a proper spraying apparatus is a rather serious one, since in this direction a considerable amount of money should be expended. A steam apparatus will do the work with much greater rapidity than a hand pump, and yet with a strong double acting force pump, which can be operated by a single man, and a tank of 100 gallons capacity mounted on a strong cart, many large trees can be well sprayed in the course of a day. From such a pump two lines of hose may be run with advantage. The working force of such an apparatus should be a horse to draw the cart, a man to drive and do the pumping, and one man to each of the lines of hose. Several such machines have been used with good results in the work of the Gypsy Moth Commission, both for street trees and in the public parks. A steam apparatus, however, of such a capacity that a pressure of 75 pounds per square inch may be gained, will enable the operation of four or five lines of hose simultaneously. The rapidity of work will therefore be doubled, and certainly by the use of two such pumps the shade trees of any ordinary city can be gone over with sufficient rapidity to destroy all insects within the required time. A boiler mounted on a truck, the boiler to be complete with all fixtures—smokestack, bonnet, firing tools, and springs to the truck—and a pump having a capacity of 10 to 20 gallons a minute connected up to the boiler ready for operation, can be purchased for a sum well within \$500. This truck should be mounted on wheels with broad tires. Connecting this apparatus with a proper tank cart would be an additional expense, not to exceed \$100 for a tank of a capacity of 200 gallons. Such an apparatus furnished with hose and smooth bore nozzles of one-sixteenth inch diameter, when discharging, under 40 pounds pressure, from each of several such nozzles, would spray about half a gallon of insecticide mixture per nozzle per minute.

A strong steam pump to be used in connection with a small oil-burning boiler, the whole apparatus on a smaller scale than that described above, has been estimated at \$275 by a prominent New York firm, delivered on board the cars.

There is no reason why an old steam fire engine could not be readily arranged for this shade tree spraying work. In a few instances a steam fire engine has been used for this purpose without modification, the object being simply to knock the insects from the trees by means of a strong stream of water. By such means as this Col. John M. Wilson, U.S.A., now Superintendent of Public Buildings and Grounds in Washington, kept the elms green at West Point several years ago, when he was superintendent of the Military Academy. In every large city, where the fire department is necessarily kept in the best condition, an engine is occasionally retired. The transfer of such a retired engine to the street department could no doubt be readily made, and a little work by a competent steam fitter would transform it into a most admirable insecticide machine. In this way the initial expenditure for machinery would be avoided.

When the spraying apparatus has been once provided, the funds necessary for the purchase of insecticides and the necessary labor must be available at the proper time. If the work is not done promptly and at just the right time, more or less damage will result, and a greater expenditure will be necessary. During the latter part of May and the first of June, in the case of nearly all prominent leaf-eating shade tree insects, one or two thorough sprayings must be made. In fact, a second spraying, begun immediately after the completion of the first one, will be in ordinary cases as much as need be expected. In addition to this spraying work, a force of men must be employed for a time in July to destroy the elm leaf beetle larvæ as they are descending to the ground and to burn the webs of the first generation of the fall webworm. This will finish the summer work. The winter work will consist of the destruction of the eggs of the white marked tussock moth, the cocoons of the fall webworm, and the bags of the bagworm. The number of men to be employed, and the time occupied, will depend upon the exigencies of the case. Upon the thoroughness of this work will depend to a large extent the necessity for a greater or less amount of the summer work just described.

We have now to consider what can be done by citizens where city governments will not interest themselves in the matter. It is unreasonable to expect that a private individual will invest in a spraying apparatus and spray the large shade trees in front of his grounds; therefore, in spraying operations where large trees exist in numbers there must be combination of resources. This affords an opportunity for the newly invented business of spraying at so much per tree. In Bridgeport, Conn., Mr. W. S. Bullard, who was formerly and is yet for the greater part of the year a roofer and paver, has constructed several cart sprayers, and during the months of June and July (at a time, by the way, when the men in his employ are apt to be out of work) he sprays trees on the grounds of private individuals and along the streets in front of their grounds, under contract, at so much per tree, guaranteeing to keep the trees in fair condition during the season. His work has been directed solely against the elm leaf beetle, since that is the only insect of great importance in Bridgeport. In the month of July last the writer, in driving through the streets of Bridgeport, found it easy to pick out the trees which had been placed in Mr. Bullard's care. Such elms were green, while all others were brown and nearly leafless. The defect of this plan as a general practice lies in the fact that not all property owners or residents can afford to employ a tree sprayer, while others are unwilling, since they deem it the business of the city authorities or do not appreciate the value of tree shade.

Any effort, therefore, looking toward the arousing of popular sentiment or the banding together of the citizens in the interest of good shade is desirable. A most excellent plan was urged by one of the Washington newspapers the past summer. It advocated a tree protection league, and each issue of the paper through the summer months contained a coupon which recited briefly the desirability of protecting shade trees against the ravages of insects and enrolled the signer as a member of the league, pledging him to do his best to destroy the injurious insects upon the city shade trees immediately adjoining his residence. This was only one of several ways which might be devised to arouse general interest. The average city householder seldom has more than half a dozen street shade trees in front of his grounds, and it would be a matter of comparatively little expense and trouble for any family to keep these trees in fair condition. It needs only a little intelligent work at the proper time. It means the burning of the webs of the fall webworm in May and June; it means the destruction of the larvæ of the elm leaf beetle about the bases of the elm trees in late June and July; it means the picking off and the destruction of the eggs of the tussock moth and the bag of the bagworm in winter, and equally simple operations for other insects, should they become especially injurious. What a man will do for the shade and ornamental trees in his own garden he should be willing to do for the shade trees ten feet in front of his fence.

L. O. Howard,
Entomologist, United States Department of Agriculture.

* A circular of the Division of Entomology, United States Department of Agriculture.

NANSEN TELLS HIS STORY.

NEW DETAILS ABOUT HIS GREAT JOURNEY.

Dr. Fridtjof Nansen has written for the London Chronicle a detailed story of his wonderful Arctic journey, which appeared in that newspaper in its issues of November 2, 3, and 4. His narrative supplies many interesting details not hitherto made known about the various phases of his journey. Here are extracts, for which we are indebted to the New York Sun.

LIFE ON THE FRAM.

"On the whole, the time passed as pleasantly as possible on board. Every man was on the best of terms with his neighbor, and did his duty with a will. Care was of course taken to provide occupation, but, even without this, time did not hang heavy on our hands. For those who were not continually occupied in scientific observations and investigations there was abundant entertainment in a capital library, games, music, various kinds of work, etc., and I think hardly any of us greatly felt the monotony complained of in all Arctic expeditions. For us who had charge of the scientific observations there was more work than we could get through. The Fram, in fact, constituted an observatory of the best kind for scientific investigations of all kinds; and it is therefore scarcely to be wondered at that we should bring home such abundant material as few expeditions before us have done.

"Lieutenant Sigurd Scott-Hansen was responsible for the meteorological, magnetic, and astronomical observations, which, I venture to say, are exceptionally complete. Dr. Blessing undertook the greater part of the botanical investigations and observations, of the aurora borealis, and also, of course, his physiological and medical observations, which are by no means unimportant. In addition to these, zoological researches were made on board, soundings, determination of the temperature, and the salinity of the sea water, observations of the atmospherical electricity, and much besides.

"The speed at which we drifted was continually changing, and our course, in consequence, was not a straight line. Sometimes we drifted forward, but at others we went back again, and were our course to be marked on a map as it actually was, it would be such a confusion of loops and knots that no one would be able to make anything of it. As we expected, we drifted most in a northwesterly direction in the winter and spring, while northerly winds stopped us in the summer.

PUTTING THE FRAM TO THE TEST.

"On January 4 and 5, 1895, the Fram was subjected to the greatest pressure we experienced. Before we set out on our expedition the great Arctic authority, Sir Leopold McClintock, gave it as his opinion that the Fram would be able to withstand the ice pressure in the summer, but that if she were exposed to it in the winter he believed the probability of her being able to stand the pressure, or raise herself, was very slight. Other Arctic authorities expressed themselves yet more strongly, saying that it was an impossibility for any ship to stand the ice pressure in the winter. Now, however, the Fram was not only to be exposed to winter pressure, but she was then fast frozen in ice of over thirty feet in thickness, a fact of which I had previously ascertained the truth by boring.

"Across this ice immense masses of ice came gliding with irresistible force against our port side. The pressure was tremendous. The ice piled itself up above the gunwales and high up the rigging, threatening, if not to crush her, at least to bury her. Scarcely a man on board believed she could live. The necessary provisions, canvas 'kayaks,' cooking utensils, fuel, tents, hand sledges, and 'ski' were all brought in safety onto the ice. All hands were ready to leave the ship, and no one was allowed to sleep unless fully clothed.

"But the Fram proved to be stronger than our faith in her. When the pressure was at its height, and for the first time, her timbers and beams began to creak; she broke loose and was slowly lifted up out of the icy berth in which she had been fast frozen.

"It was a triumph. By putting together the very worst possibilities, I could hardly imagine a more dangerous position for a vessel, and after that experience I consider the Fram to be capable of anything. Notwithstanding the most careful examination, we have not yet been able to discover a single crack, a single splinter displaced in her.

"After this it became comparatively quiet as regards the pressures, and we drifted on rapidly in a northerly and northeasterly direction."

THE SLEDGE EXPEDITION.

Dr. Nansen tells how he happened in February, 1895, to leave his ship and set out by sledge for the highest northing he could make:

"As I now thought I could assume with certainty that the Fram in a short time would reach her highest latitude north of Franz Josef's Land, and as early as the following summer would, as our plan presupposed, be near the sea north of Spitzbergen, I thought the time had come to carry out a new plan which I had for some time entertained, namely, to examine the sea north of the Fram's course. This could only be done by a sledge expedition, which could not reckon upon getting back again to the Fram, as the chance of refinding a vessel drifting in the ice was small. As a journey of this kind might appear to be fraught with some risk, should unforeseen hindrances be met with, I felt that I could not take the responsibility of sending anyone else, and therefore decided to go myself, although there was no lack on board of those who were more than desirous of going. I chose as my companion Lieut. Johansen, who gladly accepted the offer of going. The command of the remainder of the expedition on board the Fram I left in Sverdrup's hands.

"I of course felt some hesitation in thus leaving my companions and placing the responsibility for their wellbeing and safety in the hands of another; but with the perfect confidence that I had in Sverdrup's capability as a leader, and power of overcoming difficulties, I had no fear of his not bringing all hands safely home, even should the worst happen and they had to abandon the Fram—an event, however, which I deemed highly improbable.

"All the winter I had been busy making preparations for this expedition. I had had new, strong sledges made on board specially calculated for being drawn by dogs over the uneven ice. Next I had made two kayaks, twelve feet in length and so roomy that they could each carry a man with provisions for four months, as well as some dogs on the deck. The framework of these was made of bamboo and covered with canvas. When completed they weighed about forty pounds each. The provisions, which consisted exclusively of the best kinds of dried and greatly condensed articles of food—chiefly dried meat, dried fish, steam-cooked oatmeal, biscuits, butter, etc.—were stowed away in canvas bags of convenient size. We had constantly driven the dogs to keep them in training for the journey, and all kinds of experiments had been tried with the tent, sleeping bag, etc.

A FALSE START.

"It was my intention to leave the Fram as soon as the dawning polar day would allow of our traversing the rough drift ice. So on February 26, with six sledges, twenty-eight dogs, two kayaks, and provisions for men and dogs for several months, Johansen and I left the Fram. However, after four days' toiling with all these sledges over the rough ice, we saw that, thus heavily laden, we should not be able to reach our goal in good time. The dogs could not on this ice draw as much as we had expected of them, and we therefore decided to return to the ship in order to reduce the number of our sledges and the quantity of our provisions and to wait a little longer before setting off.

"On March 3, just as we were approaching the Fram, the sun appeared above the horizon for the first time that spring, after the longest polar night ever experienced by man. Observations taken on the same day showed that we had reached a latitude of 84° 4′ N.

"A few days were again spent in preparations. It was now my plan only to take with us dog provisions for one month and provisions for the men for a hundred days, and with this light equipment try to pass quickly on over the ice. We thus need not set off so early, and it was not until March 14 that we again said farewell to our companions, this time in earnest. We had now only three sledges, on two of which lay our two kayaks, and we had the same twenty-eight dogs as before.

THE TOUGHEST OF MARCHING.

"It was my hope as we got further north that we should find smoother ice, the ice there being older, and its unevenness therefore better covered up by the drifting snow. This appeared at first to be the case. We found the ice tolerably easy to get over, and did some good days' marches. On March 22 we had already reached 85° 10′ north latitude, and we calculated that we could cover greater and greater distances as the sledge loads grew lighter with the daily consumption of food on the part of both men and dogs. The dogs, too, seemed to hold out fairly well. But by and by the floes began to be more uneven and packed together, and the drift, which until then had seemed to be slight, was now against us.

"On March 25 we had reached 85° 19′ north latitude; on the 29th, 85° 30′. The ice was obviously drifting southward at a good rate, while at the same time our progress over the rough ice was slow. It was a never-ending labor, forcing our way through and getting the sledges over the high hummocks and piled up ridges of ice which were always being formed afresh, and which the snow storm never had time to smooth over. On such ice the dogs, of course, were of very little assistance. When they came to obstacles such as these they waited patiently until we had carried the sledges safely over, and they could once more draw them on over a short stretch of level ice to a fresh obstacle.

PACKING OF THE ICE.

"The ice was in constant movement and thundering around us on all sides. On April 3 we were in 85° 59′ north latitude. We pushed on with all our might, always hoping for better ice. On April 4 we reached 86° 3′, but the ice grew worse, until at last on April 7 it was so bad that I thought it unadvisable to continue any further toward the north. If it were like this in the direction of Franz Josef's Land we might have difficulty enough in getting there. We were then in 86° 14′ north latitude and about 95° east longitude. In order to investigate the state of the ice and the possibility of advance, I went further north on ski, but could discern no likely way. From the highest hummock I could find I saw only packed and piled up ice as far as the horizon.

OVERLIGHT CLOTHING.

"The first time we set out from the Fram we had had our good warm wolfskin clothes with us; but as spring was approaching and the temperature had lately been comparatively high, we did not think we should again have very low temperatures, and therefore, to save weight and make the caravan as easy of transport as possible, we reduced the outfit to a minimum and left our warm fur clothing on board when we left the Fram for the second time, a proceeding that we were to repent bitterly.

"For about three weeks the temperature remained at about 40 below zero, rising on April 1 to 7·6 below zero, but soon sinking again to 36·4 below zero. With such a temperature and a wind, we often felt it bitterly cold in our good, but too light, woolen clothing, which, owing to the perspiration of the body, was gradually transformed into an icy coat of mail. It was worse with our outer woolen jackets, which became covered with a thick layer of ice, which it took us fully an hour to thaw every night in our sleeping bag, no little physical heat being spent on the process, and not until we had lain with chattering teeth for about an hour and a half did we begin to feel at all comfortable. A few minutes after we got out of our sleeping bag in the morning, our clothes were again transformed into ice, and I scarcely think that either Johansen or I will ever wish for a repetition of those days. In March, the minimum temperature was 49° below zero, the maximum 4° below zero."

DEATH AMONG THE DOGS.

Dr. Nansen then describes the journey to Franz Josef Land, one of the most interesting features of which relates to his dogs. He says:

"Our progress was greatly hindered by the cracks and channels in the ice. In that low temperature they were as a rule covered with a thin sheet of ice, which made it impossible to use our kayaks in getting across. We were therefore often compelled to go a round of many miles, and it would sometimes take half a day to get past a channel of this kind. The further south we came the more of these there were, and they greatly hindered our advance, while provisions were dwindling and the dogs had to be killed one after another to feed the remainder. Some of the dogs at first evinced great aversion to eating their companions, but as their hunger increased and they got nothing else to eat they gradually became so voracious for this food that it was difficult to keep them from it as soon as a dog was killed.

"Their rations had to be gradually reduced to the smallest possible amount, so as to make the little we had go far enough and keep them alive as long as possible, but by degrees they grew sadly worn out. Many of them drew their load faithfully until they suddenly dropped down with fatigue, unable to stand any longer. We then had no other choice than to kill them on the spot or to lay them on one of the sledges and take them with us to kill them when we pitched our camp in the evening.

"In June the channels became more numerous and more difficult than ever to deal with, and the state of the ice was very bad. Dogs, ski, and sledge runners broke through the crust on the snow, and sank deep into the soft and wet snow beneath. The number of dogs now, too, was very small, and was continually diminishing. Advance seemed almost hopeless, but we had no choice, and so toiled on as best we could, while the rations for both dogs and men were reduced to a minimum."

When he finally came within sight of land, on August 6, Nansen had only two dogs left. He shot them and left them on the drift ice.

UNDER A BEAR'S PAW.

When nearing Franz Josef Land Nansen and Johansen shot three bears, and came near having a very serious adventure with the fourth they killed. They were about to cross a channel in the ice in their kayaks.

"We had just brought my kayak up to the edge of the floe, and while I was busy with it Johansen turned back to draw up his kayak beside it. Suddenly I heard a noise behind me, and turning saw Johansen on his back with a bear over him, and holding the bear by the throat. I caught up my gun, which lay on the foredeck of my kayak, but at the same moment the boat slid into the water, and the gun with it. By exerting all my strength I hauled the heavily laden kayak up again, but while doing so I heard Johansen quietly remark, 'You must hurry up if you don't want to be too late.' At last I got the gun out of its case, and as I turned round with it cocked the bear was just in front of me. In the hurry of the moment I had cocked the right barrel, which was loaded with shot, but the charge took effect behind the ear and the bear fell down dead between us. The only wound Johansen had received was a slight scratch on the back of one hand, and we went on our way well laden with fresh bear's flesh."

BUILDING A HUT.

They landed at the spot where they made their winter quarters with scarcely anything except their boat kayaks, guns, and ammunition. Nansen continues:

"We immediately set to work to shoot walrus, the blubber of which we intended to use for firing. For two men, however, the manipulation of these huge animals was attended with considerable toil. We had at last to give up dragging them up on land or onto the ice, and our only expedient was to lie on them in the water while removing the hide and blubber, during which process we succeeded in getting our only clothes thoroughly saturated with oil and dirt, thus rendering them peculiarly unfitted for protection against the winter cold and storms. There was no scarcity of bears, and we shot them for our winter store of food. After having laid in a temporary supply we set to work on our hut, which was built of stone, earth and moss. How we were to roof it seemed at first a difficult problem to solve. Fortunately, however, we found a piece of drift timber cast up on the shore. This we used as the ridge piece of the house, and stretched walrus hides over it, weighted at the edges on both sides with large stones. On the top of this we laid snow. To build a chimney was not easy, as we had not the stones necessary. Our only expedient was, therefore, to build it of ice and snow, which had to be renewed, however, two or three times in the course of the winter.

A DREAM OF MARBLE HALLS.

"For cooking, lighting and heating we used walrus blubber and bear's fat. Bear's flesh and fat was our only food. In the evening we fried it in a large aluminum frying pan; in the morning we boiled it. We made our bed and sleeping bag of bearskin. To keep warmer we both slept in one bag, and, taken altogether, we were quite comfortable in our low hut, of which a great part lay below the level of the ground, and was, therefore, fairly well protected from the violent winter storms which continually raged above it. By the help of our lamps we succeeded in keeping the temperature inside at about freezing point, while on the walls it was, of course, considerably lower. These were covered with a thick coating of rime and ice, which in the lamplight imparted a beautiful marmoreal appearance to the walls of the hut; so that in our happier moments we could dream that we dwelt in marble halls. The hut was about ten feet long, six feet broad, and high enough in some places to allow of our standing almost erect. Our couch was formed of rough stones; we never quite succeeded in getting it even tolerably even, and our most important business throughout the winter was, therefore, to bend the body into the most varied positions in order to discover the one in which the pressure of the stones was least felt.

HOW TIME PASSED.

"We had no work which could help to make the time pass; we did little else than sleep, eat, and then sleep again. If any one still holds the old belief that scurvy arises from want of exercise, this is a striking proof that such is not the case. Strange to say, our appetites continued unimpaired the whole time, and we always consumed our bear's flesh and our fat with the same voracity. When the weather permitted we would take an hour's walk every day in the dark outside the hut, but often it was so stormy that it was not expedient to put one's nose beyond the passage which led to our palace. Several days would often pass in which we would lie quite still, until at last a scarcity of ice to melt for drinking water, or of food, compelled us to go out to fetch ice or to drag in the carcass or leg of a bear. After November we were not visited again by bears until March, and our only company in the winter were a number of foxes which constantly sat upon the roof of our hut, whence we could hear their perpetual gnawing at our frozen hams. It made us often dream that we were sitting comfortably at home listening to the rats in the loft above; and we by no means grudged them a little of all our abundance. These foxes were both of the white variety and of the valuable dark furred kind, and had we been so inclined we could easily have laid by a good store of valuable furs. Our supply of ammunition, however, was not so large as to allow, in my opinion, of our spending it upon them, for it seemed to me that bears was the smallest game that could give us any return for our cartridges.

"Upon the whole, the winter passed in a manner beyond our expectation. Our health was excellent, and if we had only had a few books, a little flour, and a little sugar, we were both agreed that we could have lived like lords.

SPRING AT LAST.

"At last came spring with sunshine and birds. How well I remember that first evening, a few days before the sun had appeared above the horizon, when we suddenly saw a flock of little auks (rotges) sail past us along the mountains to the north. It was like the first greeting from life and spring. Many followed in their train, and soon the mountains around us swarmed with these little summer visitors of the north, which enlivened everything with their cheerful twittering. A dark sky, which we had had the whole winter, but especially now in the spring, in the south and southwest seemed to imply that there must be water in that direction, of which it was a reflection. We had, therefore, every hope of making a quick and easy voyage in our kayaks across to Spitzbergen, partly over open water, partly

over drift ice; and as daylight had now returned we busied ourselves in preparations for this journey.

LIFE WITHOUT SOAP.

"There was much, however, to be done before we could set off. Our clothes were so worn out and so saturated with fat and dirt that they were anything but suitable for a journey of this kind. We therefore made ourselves two entire new suits out of two blankets we had brought with us. Our underclothing we tried to wash as best we could, but never before did I know what it was to exist without soap. It was difficult enough to get one's person clean, but this we managed to a certain extent by rubbing in bear's blood and fat, and then rubbing this off with moss. But this process was not applicable to clothes. After trying every possible way, we found, in our despair, no other expedient than to boil them as we best could and then scrape them with a knife. In this way we got so much off them that they did to travel with, though the thought of putting on clean clothes when we once more got back to Norway was always in our minds as the greatest enjoyment that life could bestow. We had to make a new sleeping bag of bear skins, which we dried and prepared by stretching them out under the roof of our hut. Our good, precious silk tent, which we had had during the whole of the preceding year's journey, had at last, during the autumn storms, become so worn out that I did not think it could be used any more. We were now, therefore, obliged to employ our sledge sails as a tent. Our provisions for the journey were chiefly bear's flesh and fat, and our fuel was train oil and blubber, and we were sure of finding sufficient game on the way when the provisions we took with us gave out."

ATTACKED BY A WALRUS.

On the way south to Jackson's camp they were attacked by a walrus.

"These monsters had tried several times to put an end to us by suddenly coming up from below and attacking the kayak with a violent blow, which might easily have upset us, but this they had hitherto not succeeded in doing. This time, however, the attack was more violent. The walrus suddenly pushed up beside my kayak, and, laying one flipper on its edge, tried to upset it, at the same time driving its long tusks into the bottom, fortunately, however, without touching me. I managed to give the walrus such a blow on the head with the paddle that it rose high up out of the water, threatening to fall upon me, but disappeared the next moment as quickly as it had come. The water was rushing into the kayak through the long rent made in the bottom by the walrus, and I was sinking rapidly, and only at the last moment managed to run my kayak onto a floe that was projecting under the water, and escaped in safety from the boat onto the ice. The next day was employed in repairing the kayak and in drying clothes, outfit, photographic apparatus, etc., which were all soaked with sea water, though fortunately no real harm was done."

The meeting with Jackson's party a few days later has already been described in the SUPPLEMENT.

SICKNESS AND MORTALITY IN THE GERMAN NAVY.

THE average strength of the German navy during the biennial period ending March 31, 1893, was 17,888 of all ranks, the numbers afloat and ashore being respectively 9,262 and 8,626. The exemptions from duty for disease or accident amounted to 910 per 1,000 of strength, each case remaining 13·3 days under treatment on an average, while the number of men constantly sick was equal to 34·2 per 1,000. Infectious diseases accounted for nearly 7 per cent. of the total disability, inclusive of 65 cases of scarlet fever, 69 of measles, 8 of diphtheria, 36 of typhoid fever and 2 of cholera. Paludal fevers caused 771 admissions in African waters, the ratio to the local morbidity from all causes being 420 per 1,000, but elsewhere the incidence of these affections was inconsiderable. Out of every 1,000 cases treated, diseases of the respiratory organs (including phthisis pulmonalis) were responsible for 104·5, accidents for 190·7, venereal diseases for 107·4 and rheumatism for 15·1. Sunstroke occurred 23 times and a single case of scurvy was reported from a vessel cruising in the South Pacific. With regard to the venereal sick roll it is worthy of note that the proportion of cases occurring in Eastern waters was three times higher than that given above. In this connection Dr. H. Gros, the compiler of an interesting résumé of the official returns, makes the following observation: "The relative infrequency of these affections is remarkable. In all probability the morals of the German sailor are not superior to those of his congeners belonging to other nationalities. To what, then, are we to attribute his greater immunity? Is it to be ascribed to surveillance of prostitutes, to the retention of the men on board ship, or to the concealment of disease? It is impossible to say." * During the period there were 112 deaths, 70 at sea and 42 on land, the mortality being thus equal to 6·2 per 1,000 per annum. No fewer than 35 of the fatalities afloat were caused by accidents, and 3 were due to suicide. Among the deaths on shore, suicide was responsible for 4 and accidents for 7. The number of fatal cases from disease was as follows: Tuberculosis, 22; pleurisy and pneumonia, 15; pyæmia, 8; typhoid fever, 3; paludal fever, 3; cholera, 2; diphtheria, 2; scarlet fever, 1; rheumatism, 1, and other diseases, 11. 847 men were permanently discharged in the course of the two years, more than half of them having less than three months' service. The loss under this head was consequently equal to 23·6 per 1,000. It was due chiefly to visual defects, diseases of the locomotor apparatus, heart complaints, general debility and affections of the ear. The invalids numbered 395 (11·0 per 1,000), their disabilities being for the most part cardiac and locomotor, with hernia and tuberculosis in the second rank.—Lancet.

Packing Plates.—According to Colson, the best paper in which to pack sensitive plates is obtained by soaking it in a three per cent. solution of potassium bichromate to which some gum arabic has been added, exposing thoroughly to light and then washing till all trace of bichromate is washed out. Such a paper is impermeable to damp or gases of all kinds.

* Archives de Medecine Navale et Coloniale, October, 1896.

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